Inventory of the Reptiles and Amphibians of the Gulf Islands National Seashore

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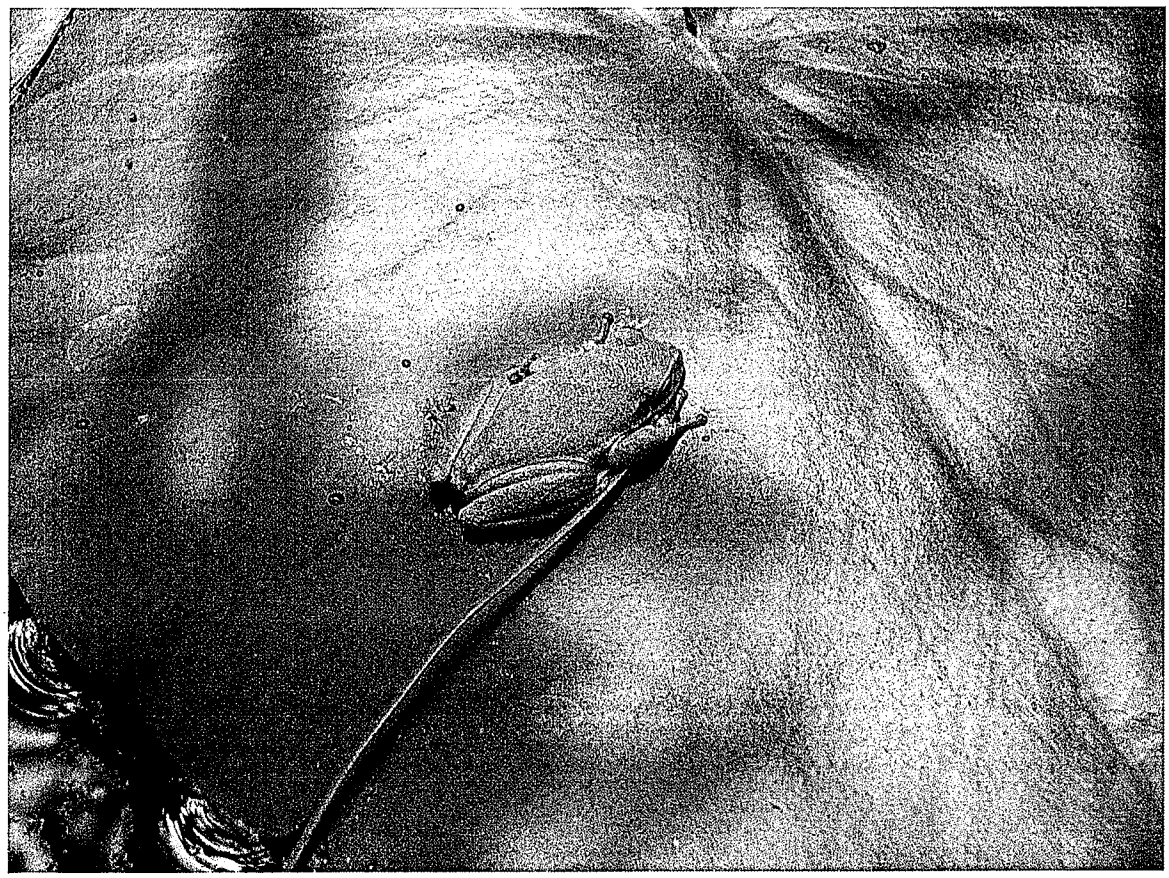

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Final Report

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National Park Service
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Table of Contents

List of Figures

List of Tables

List of Appendences

Summary

Beginning in January, 2004 and continuing through July, 2006, we conducted investigations to determine historic and current species richness of herpetofauna in the Gulf Islands National Seashore (GUIS). Composed of two districts (Florida and Mississippi), GUIS contains many unique and increasingly important coastal habitats. As the popularity of living in the Gulf Coast region continues, parks and wilderness areas will undoubtedly play significant roles in preserving our nation's native biodiversity.

Our primary goal, as identified by the National Park Service (NPS), was to document the presence of at least 95% of the amphibian and reptile species of each park unit we surveyed. By utilizing standard herpetological sampling techniques we conducted surveys on six park units in the Mississippi District and five park units in the Florida District. We documented a total of 51 unique taxa in GUIS, 19 amphibian and 32 reptile. Included in those species were one federally listed threatened species: the gopher tortoise (*Gopherus polyphemus*), and two exotic species: the greenhouse frog (*Eleutherodactylus planirostris*) and the Mediterranean gecko (*Hemidactylus turcicus*).

Historic observations show that several species previously documented in the park prior to this survey may no longer occur. Keeping in mind the environmental conditions herpetofauna face in GUIS, such as availability of fresh water, heat, desiccation, fire, frequent storms and hurricanes, island migration, and geologic re-shaping, it is not surprising that some park herpetofaunal communities are very dynamic. As these physical factors naturally affect GUIS, herpetofaunal communities will continue to change in species composition, richness, and diversity.

Acknowledgements

We thank the National Park Service's Gulf Coast Inventory and Monitoring Network for supporting and funding this research, including the original co-operative agreement: "Inventory of Reptiles and Amphibians of the Gulf Islands National Seashore." The success of this research should also be shared with the staff of the Gulf Islands National Seashore whose continuous support has provided indispensable assistance. Specifically, we thank Whitney Granger for his technical support in preparing this report and managing our data. We thank Jim Graves and Joey Tyson for logistical support on West Ship Island, and Pam Pierce for keeping a campground space open for us at Davis Bayou. We thank Riley Hoggard for his advisory and technical expertise and Roxanne Sellers for her assistance in submitting and cataloging museum specimens. Finally, we thank Gary Hopkins whose extensive local knowledge and continuous logistical support were vital to the success of this project.

The success of this survey would not have been possible without the help of the numerous individuals listed below. We thank Krista Noel for assistance in scouting sampling localities, identification of specimens, field assistance, and for serving as an objective sounding board. We thank Sam Holcomb for numerous hours in the field whose only rewards were blood, sweat, and unlimited hot dogs. Additionally, we thank A.H.M. Ali Reza, Nishant Pillai, and Rajeev Chauhan of the Asian Scholarship Program for their assistance in the field. We thank Josh Ennen for his enthusiasm for herpetological sampling and DNA collection. We thank Christina Watters for conducting the first museum record searches and editing assistance. Finally we thank Danna Baxley, Will Selman, and Brian Kreiser for assistance in the field and laboratory.

INTRODUCTION

In partial fulfillment of the requirements of the National Park Service (NPS) Cooperative Agreement H2115030006, the following final report has been compiled. The report details a three year herpetofaunal inventory of the Florida and Mississippi Districts of the Gulf Islands National Seashore (GUIS), conducted by the University of Southern Mississippi from 2004 - 2006. We subsequently added three separate modifications to the initial cooperative agreement. Modification one: we sampled recently acquired property on Cat Island as a priority location in the 2005 sampling season. Modification two: we conducted a genetic study of *Nerodia clarkii* (Gulf Coast salt marsh snake), detailed in a separate final report. Modification three: we added an additional field season in 2006 to examine the immediate impacts of Hurricane Katrina on the Mississippi District. Throughout this report abbreviations used to designate individual park units in tables are: "CI" Cat Island, "WSI" West Ship Island, "ESI" East Ship Island, "HI" Horn Island, "PBI" Petit Bois Island, "DB" Davis Bayou, "PK" Perdido Key, "FP" Fort Pickens, "SR" Santa Rosa Island, "NLO" Naval Live Oaks, and "OK" for Okaloosa.

HISTORICAL DOCUMENTATION

The southeast region of the United States is well documented for having the greatest diversity of herpetofaunal species in the country. Mississippi has attracted scientists and researchers to study the state's herpetofauna since the turn of the 20th century. Florida, perhaps more than any other state, has long attracted herpetologists from around the county and the world. Researchers who have spent time documenting the amphibians and reptiles of the Gulf Islands National Seashore are discussed in the following section of this report, starting from the oldest to the most recent published accounts.

1932, Morrow J. Allen: "A survey of the Amphibians and Reptiles of Harrison County, Mississippi."

Herpetofaunal surveys of Harrison County, Mississippi were conducted by Allen from 1929 to 1932. Although the majority of these surveys took place outside of GUIS, Allen does report on specimens found on Horn and Cat Islands. It is possible that the area of and around Davis Bayou was also sampled, but no reference is given to of either current or historic names. Table 1 lists all specimens identified by these surveys from GUIS localities. One noteworthy specimen from Cat Island is a western ribbon snake (*Thamnophis proximus*). Although Allen does not list a sub-species, based on range maps in Conant 1998, it is most probably a gulf coast ribbon snake (*T. p. orarius*).

Table 1: Historic Documentation of Herpetofaunal species, Allen, 1932

Species	Common name	Location(s)
Bufo terrestris	southern toad	CI
Hyla squirella	squirrel treefrog	CI, HI
Cnemidophorus sexlineatus	six-lined racerunner	HI
Nerodia cyclopion	Mississippi green water snake	HI
Nerodia clarkii	Gulf salt marsh snake	HI
Thamnophis proximus	western ribbon snake	CI

1955, Philip W. List and James C. List: "Notes on Mississippi Amphibians and Reptiles."

Table 2 lists the species documented within GUIS by List and Smith during their 1951 stay at the Gulf Coast Research Laboratory in Ocean Springs, MS. Their surveys were limited to July and August, however they collected over 800 specimens including a few from Horn and Cat Islands. Of note, they documented the western pygmy rattlesnake (*Sistrurus miliarius streckeri*).

In addition to the species listed in Table 2, List and Smith collected from areas around Ocean Springs, which may have included Davis Bayou. Unfortunately, no place names are given so it is impossible to tell the exact location of the sampling. For more information see List and Smith 1955.

Table 2: Historic Documentation of Herpetofaunal species, Smith and List, 1955

Species	Common name	Location(s)
Bufo terrestris	southern toad	HI, CI
Anolis carolinensis	green anole	HI, CI
Cnemidophorus sexlineatus	six-lined racerunner	HI, CI
Eumeces inexpectatus	south eastern five-lined skink	CI
Scincella lateralis	ground skink	HI, CI
Agkistrodon piscivorus	cottonmouth	HI, CI
Sistrurus miliarius streckeri	western pygmy rattlesnake	CI

1962, and 1968, E. Avery Richmond: "The Fauna and Flora of Horn Island Mississippi" and "Supplement to the Fauna and Flora of Horn Island Mississippi."

The first dedicated and thorough survey conducted on a GUIS locality was conducted by Richmond in 1962, and then his supplement in 1968. His surveys found 29 species of amphibians and reptiles on Horn Island (Tables 3 and 4).

Table 3: Herpetofaunal species documented by Richmond, 1962

Species	Common name	Location(s)
Acris gryllus	southern cricket frog	HI
Bufo terrestris	southern toad	HI
Hyla cinerea	green treefrog	HI
Hyla squirella	squirrel treefrog	HI
Alligator mississippiensis	American alligator	HI
Chelonia mydas	green sea turtle	HI
Malaclemys palustris	diamondback terrapin	HI
Pseudemys concinna	river cooter	HI

Anolis carolinensis	green anole	HI
Cnemidophorus sexlineatus	six-lined racerunner	HI
Eumeces fasciatus	five-lined skink	HI
Ophisaurus ventralis	eastern glass lizard	HI
Scincella laterale	ground skink	HI
Agkistrodon contortrix	copperhead	HI
Agkistrodon piscivorus	cottonmouth	HI
Coluber constrictor	southern black racer	HI
Heterodon platirhinos	eastern hognose snake	HI
Lampropeltis getulus	speckled kingsnake	HI
Masticophis flagellum	eastern coachwhip	HI
Natrix clarkii	Gulf salt marsh snake	HI
Natrix cyclopion	green watersnake	HI
Natrix sipedon	broad banded watersnake	HI

Table 4: Historic Documentation of Herpetofaunal species, Richmond, 1968

Species	Common name	Location(s)
Hyla crucifer	spring peeper	HI
Hyla femoralis	pine woods treefrog	HI
Hyla gratiosa	barking treefrog	HI
Pseudacris nigrita	southern chorus frog	HI
Pseudacris ornata	ornate chorus frog	HI
Chelydra serpentina	snapping turtle	HI
Sceloperus undulatus	fence lizard	HI

1970, Crawford Jackson and Marguerite Jackson: "Herpetofauna of Dauphin Island, Alabama."

Although Dauphin Island is not part of GUIS, the survey of its herpetofauna is included in this report due to similarities of habitat, geography and shared geologic history. Table 5 shows the results of their 1969 pre-Hurricane Camille survey.

Table 5: Historic Documentation of Herpetofaunal species, Jackson et al, 1970.

Species	Common name	Location(s)
Ambystoma talpoideum	mole salamander	Dauphin Island, AL
Ambystoma tigrinum	tiger salamander	Dauphin Island, AL
Amphiuma means	two-toed amphiuma	Dauphin Island, AL
Notopthalmus viridescens	central newt	Dauphin Island, AL
Gastrophryne carolinensis	narrowmouth toad	Dauphin Island, AL

Scaphiopus holbrooki	eastern spadefoot	Dauphin Island, AL
Bufo quercicus	Oak toad	Dauphin Island, AL
Bufo terrestris	southern toad	Dauphin Island, AL
Hyla cinerea	green treefrog	Dauphin Island, AL
Hyla crucifer	spring peeper	Dauphin Island, AL
Rana grylio	pig frog	Dauphin Island, AL
Rana pipiens sphenocephala	southern leopard frog	Dauphin Island, AL
Kinosternon subrubrum	mud turtle	Dauphin Island, AL
Deirochelys reticularia	chicken turtle	Dauphin Island, AL
Malaclemys terrapin pileata	MS diamondback terrapin	Dauphin Island, AL
Pseudemys alabamensis	Alabama red-bellied turtle	Dauphin Island, AL
Terrapene carolina major	Gulf Coast box turtle	Dauphin Island, AL
Caretta caretta	loggerhead	Dauphin Island, AL
Alligator mississippiensis	American alligator	Dauphin Island, AL
Anolis carolinensis	green anole	Dauphin Island, AL
Sceloporus undulatus	fence lizard	Dauphin Island, AL
Ophisaurus ventralis	eastern glass lizard	Dauphin Island, AL
Cnemidophorus sexlineatus	six-lined racerunner	Dauphin Island, AL
Eumeces inexpectatus	SE five-lined skink	Dauphin Island, AL
Lygosoma laterale	ground skink	Dauphin Island, AL
Cemophora coccinea	scarlet snake	Dauphin Island, AL
Coluber constrictor priapus	southern black racer	Dauphin Island, AL
Farancia abacura	mud snake	Dauphin Island, AL
Heterodon platirhinos	eastern hognose snake	Dauphin Island, AL
Lampropeltis getulus holbrooki	speckled kingsnake	Dauphin Island, AL
Natrix sipedon clarki	gulf salt marsh snake	Dauphin Island, AL
Rhadinea flavilata	yellow-lipped snake	Dauphin Island, AL
Tantilla coronata	SE crowned snake	Dauphin Island, AL
Thamnophis sauritus	eastern ribbon snake	Dauphin Island, AL
Agkistrodon piscivorus	eastern cottonmouth	Dauphin Island, AL

1995, Thomas Mann: "Populations Surveys for Diamondback Terrapins (*Malaclemys terrapin*) and Gulf Salt Marsh Snakes (*Nerodia clarkii clarkii*) in Mississippi."

In 1993-1994 Tom Mann conducted surveys for *Malaclemys terrapin,* diamondback terrapin and *Nerodia clarkii clarkii*, the Gulf Coast Salt Marsh Snake in Mississippi's coastal habitats. Horn Island and Cat Island were among his study sites in this survey. Out of the 150 terrapin captures and 20 salt marsh snake captures of his survey, none were found on either Horn or Cat Islands. However, Mann does report that a salt marsh snake was seen and not captured on

Cat Island. Additionally, Cat Island was identified as a nesting site for terrapins with a minimum of 30 nests identified June, 1994.

1996, Richard A. Seigel and Sean Doody: "Final Summary Report: Inventory and Monitoring of Amphibians and Reptiles of the Gulf Islands National Seashore."

Conducted between 1992 and 1995, this survey sampled localities throughout GUIS. Species and locations documented are shown below in Table 6. Thorough surveys were conducted in Fort Pickens, Naval, Live Oaks, and Horn Island. Additional surveys were conducted in Davis Bayou, West Ship Island, East Ship Island, and Petit Bois Island.

Table 6: Historic Documentation of Herpetofaunal species, Seigel and Doody 1996.

Species	Common name	Location(s)
Amphiuma means	two-toed amphiuma	NLO
Notophthalmus viridescens	red newt	NLO
Plethodon mississippi	slimy salamander	NLO, DB
Acris gryllus	southern cricket frog	NLO, FP, ESI
Bufo quercicus	oak toad	NLO, DB
Bufo terrestris	southern toad	NLO, DB
Gastrophryne carolinensis	narrowmouth toad	NLO, ESI
Hyla cinerea	green treefrog	NLO, FP, HI, ESI, DB
Hyla femoralis	pinewoods treefrog	NLO, FP, DB
Hyla gratiosa	barking treefrog	NLO
Hyla squirella	squirrel treefrog	NLO, FP, HI, ESI, DB
Hyla versicolor	gray treefrog	DB
Pseudacris ornata	ornate chorus frog	NLO
Rana catesbeiana	bullfrog	DB
Rana clamitans	bronze frog	DB
Rana grylio	pig frog	NLO, FP, HI
Rana sphenocephala	southern leopard frog	NLO, FP, HI, PBI
Alligator mississippiensis	American alligator	NLO, PBI, HI, ESI, WSI
Chelydra serpentina	snapping turtle	NLO, FP
Gopherus polyphemus	gopher tortoise	NLO
Kinosternon subrubrum	mud turtle	FP,HI, DB
Malaclemys terrapin	diamondback terrapin	HI
Pseudemys floridana	Florida river cooter	NLO, FP
Terrapene carolina major	Gulf Coast box turtle	NLO, FP, DB

Trachemys scripta	yellow-bellied slider	NLO, FP
Anolis carolinensis	green anole	NLO, FP, HI, ESI
Cnemidophorus sexlineatus	six-lined racerunner	NLO, FP, PBI, HI, ESI, WSI
Eumeces egregius	mole skink	NLO
Eumeces laticeps	broad-headed skink	NLO
Eumeces inexpectatus	SE five-lined skink	ESI
Ophisaurus ventralis	eastern glass lizard	NLO, FP, HI
Sceloporus undulatus	fence lizard	NLO
Scincella lateralis	ground skink	NLO, FP PBI, ESI, DB
Agkistrodon piscivorus	cottonmouth	NLO, FP, PBI, HI, ESI
Cemophora coccinea	scarlet snake	FP
Coluber constrictor	southern black racer	NLO. FP, HI
Crotalus adamanteus	diamondback rattlesnake	FP
Elaphe guttata	corn snake	NLO
Heterodon platirhinos	eastern hognose snake	NLO
Masticophis flagellum	eastern coachwhip	NLO, FP
Micrurus fulvius	eastern coral snake	NLO
Nerodia cyclopion	MS green water snake	HI
Nerodia erythrogaster	yellow-bellied water snake	NLO
Nerodia fasciata	banded water snake	NL FP, HI
Nerodia floridana	Florida green water snake	NLO
Nerodia taxispilota	brown water snake	NLO
Opheodrys aestivus	rough green snake	NLO
Sistrurus miliarius	pygmy rattlesnake	NLO
Storeria dekayi	brown snake	HI
Storeria occipitomaculata	red-bellied snake	NLO
Tantilla coronata	SE crowned snake	NLO
Thamnophis sauritus	ribbon snake	NLO, FP, HI, DB
Thamnophis sirtalis	garter snake	NLO

1997, Richard A. Seigel, Brian D. Horne, and Nadia A. Seigel.: "Final report: Effects of Hurricanes Erin and Opal on the distribution and Status of Amphibians and Reptiles of the Gulf Islands National Seashore."

Following the hurricanes of Erin and Opal in 1995, Seigel et al conducted follow-up surveys of Naval Live Oaks and Fort Pickens between 1996 and 1997. The results of that study are also shown in Table 7. Interestingly, Seigel et al documented five species in the post-hurricane survey that were not detected prior to the storm. The most notable newly identified species documented was the Pine Barrens tree frog (*Hyla andersonii*). *Hyla andersonii* has a

highly disjunct distribution that includes New Jersey, North and South Carolina, Alabama and the Florida Panhandle. The survey also documented the exotic greenhouse frog (*Eleutherodactylus planirostris*) for the first time in GUIS.

Table 7: Historic Documentation of Herpetofaunal species, Seigel, et al, 1997

Species	Common name	Location(s)
Eurycea cirrigera	two-lined salamander	NLO
Amphiuma means	two-toed amphiuma	NLO
Notophthalmus viridescens	red newt	NLO
Plethodon mississippi	slimy salamander	NLO
Acris gryllus	southern cricket frog	NLO, FP
Bufo quercicus	oak toad	NLO
Bufo terrestris	southern toad	NLO, FP
Eleutherodactylus planirostris	greenhouse frog	NLO
Gastrophryne carolinensis	narrowmouth toad	NLO
Hyla andersonii	Pine Barrens tree frog	FP
Hyla cinerea	green treefrog	NLO
Hyla femoralis	pinewoods treefrog	NLO, FP
Hyla squirella	squirrel treefrog	NLO, FP
Rana grylio	pig frog	NLO
Rana sphenocephala	southern leopard frog	NLO, FP
Alligator mississippiensis	American alligator	NLO, FP
Chelydra serpentina	snapping turtle	NLO, FP
Gopherus polyphemus	gopher tortoise	NLO
Pseudemys floridana	Florida river cooter	NLO, FP
Trachemys scripta	yellow-bellied slider	NLO, FP
Anolis carolinensis	green anole	NLO, FP
Cnemidophorus sexlineatus	six-lined racerunner	NLO, FP
Eumeces egregious	mole skink	NLO
Eumeces laticeps	broad-headed skink	NLO
Sceloporus undulatus	fence lizard	NLO
Scincella lateralis	ground skink	NLO, FP
Agkistrodon piscivorus	cottonmouth	NLO, FP
Coluber constrictor	southern black racer	NLO, FP
Nerodia fasciata	banded water snake	NLO, FP
Tantilla coronata	SE crowned snake	NLO
Thamnophis sauritus	ribbon snake	NLO, FP
Thamnophis sirtalis	garter snake	NLO

METHDOOLOGY

We used classical herpetofaunal trapping techniques within each park unit to sample for all types of amphibians and reptiles. The degree and combination of techniques that were used were tailored to each park unit's size and diversity of habitats.

Sampling Methods

Drift Fences, Pitfall Traps, and Funnel Traps

Drift fences are simply low fences that are erected to impede passage and direct the movement of terrestrial animals into traps placed along the length or at the ends of the fence. We constructed drift fences from commercially available black silt fencing; fences were 100 feet in length and approximately three feet in height. Where environmental conditions permitted, up to four pitfall traps were installed with each drift fence. The pitfalls consisted of five gallon plastic buckets placed adjacent to the fence and buried in the ground so that their mouths were flush with the soil surface. A sponge or other damp cover object was placed in the bottom of each pitfall trap, and drain holes were drilled in the bottom of each bucket, to reduce the risks of trapped animals suffering from desiccation, solar exposure, or drowning. Funnel traps were placed on the ground flush with the fence, such that the fences directed animal movement into the funnel entrance. They were covered with burlap or leaf litter from the surrounding area to shade trapped animals from solar exposure. When in use, we checked all pitfall and funnel traps at least twice daily, and more frequently during hot weather, to minimize the mortality risk and stress of trapped animals. Due to the labor required for installation, drift fences and pitfall traps remained in place between sampling periods. When not in daily use, drift fence arrays were rendered inactive so that no animals would be trapped. Funnel traps were removed and pitfall traps were closed by affixing tight-fitting lids to each bucket.

Cover boards

Cover boards are flat pieces of wood or metal that are placed on the ground to provide basking and shelter sites for amphibians and reptiles. After placement, we surveyed cover boards by lifting each board to observe and/or catch animals that were beneath them, and then replacing the boards. We constructed cover boards from two different materials: 3/8 inch thick plywood and steel sheet metal; each board was two feet wide by two feet long. We placed arrays of 20 cover boards in terrestrial habitats and spaced the arrays at 10 meter intervals. The arrangement of cover boards per array (i.e., along transects or in grids) was adjusted to suit each individual sampling location. Within each array, wood and steel cover boards were alternated, because the effectiveness of the two materials varies with season. Metal covers are more effective during mild temperatures, when high thermal conductivity makes them highly suitable as basking sites; wood covers are more effective during hot or cold temperatures, when their low thermal conductivity provides insulated retreat sites. Cover boards are more effective after they "settle into" the underlying soil, so all cover board arrays were deployed in advance of their use for sampling, and were left in place between sampling periods. Unattended cover boards pose no risk to wildlife, as animals are able to come and go freely.

Minnow traps

We used commercially available minnow traps to survey amphibians and reptiles in shallow-water aquatic and wetland habitats. Minnow traps consist of a cylinder of wire mesh (1/4 inch) with inward pointing funnel entrances at each end. In addition to their intended purpose of catching small fishes, minnow traps are also effective at catching many aquatic amphibians and reptiles, including amphibian larvae, aquatic salamanders, frogs, water snakes, and small turtles. We tied or staked minnow traps in shallow water, such that the top of the trap

extended above the water to allow trapped reptiles airspace to breathe. Minnow traps were spaced about five meters apart and placed along the shallow edges of deeper water bodies, or in grids or transects within wider areas of shallow water. The exact number and arrangement of traps was tailored to the specific conditions of individual sampling locations. Minnow traps were not baited. Minnow trap arrays were deployed at a sampling site only when researchers were present to check them at least once daily, and more frequently during hot weather. Minnow traps were always checked in the morning, so that animals captured during the previous evening and night could be released before they were exposed to the heat of mid-day. When possible, all trapped amphibians and reptiles were identified upon removal from traps, then released at the site of capture. However, when positive identification was not possible at the trap site, as is common with some larval or recently metamorphosed amphibians, specimens were taken to camp for more thorough examination; they were released at the site of capture after positive identification had been made. All fishes and other non-target captures were released each time traps were checked.

Turtle Traps

We used two types of commercially available traps to survey aquatic turtles in all non-marine aquatic habitats. Hoop nets are cylindrical enclosures of nylon mesh with funnel shaped entrances to capture turtles that are lured into the trap by bait (canned sardines). These traps work well for many aquatic turtles, but not all species are attracted to the bait. A solar/basking turtle trap consists of a mesh cage suspended in the water beneath a floating platform. When the trap is placed in an area that receives full solar exposure, turtles are attracted by the opportunity to climb out of the water atop the platform and bask. Turtles are trapped in the floating cage

when they drop off the trap into the water after basking. The solar/basking trap is more effective at sampling more herbivorous turtle species, because it does not rely on a bait attractant.

PVC Pipe Sampling

We used 3.0-3.5 foot lengths of ½ inch white PVC pipe to sample for treefrogs. We used two techniques to create additional refugia in typical treefrog habitat; PVC pipe was inserted into the ground vertically near aquatic habitats (typically vegetated) or attached to small trees with bungee cords. In both techniques, the ends of the pipe were left open for access by frogs and water drainage.

Manual Searching

We utilized several manual searching techniques to survey for species not readily detected by the previously described methods and to extend the area covered by the survey. These techniques included: visual searching and hand catching, nighttime road surveys, nighttime spotlight surveys of aquatic habitats, dip netting of shallow aquatic habitats, and calling frog surveys. In general, these techniques consisted of one or more researchers moving slowly through appropriate habitat, searching for amphibians and reptiles, and catching them by hand when detected. The one exception were calling frog surveys, which were generally done by sitting still and quietly at discrete locations (i.e., anuran breeding sites) and listening for calling frogs and toads. Calling frog surveys are essential for producing a complete inventory, because many anuran species, especially some treefrogs, are not likely to be detected by any other means.

Study Sites

A combination of eleven mainland and island units, from both Mississippi and Florida districts were included in this study. In Mississippi, we conducted field surveys at Davis Bayou,

West Ship Island, East Ship Island, Horn Island, Petit Bois Island and Cat Island. In Florida, we surveyed Perdido Key, Fort Pickens, Santa Rosa Island, Naval Live Oaks and the Okaloosa Area. Park units received unequal attention and were prioritized based on: (1) level of previous documentation, (2) complexity of habitats and (3) actual size. With a goal of identifying 95% of herpetofaunal taxa, we ground-truthed each survey unit to further determine the amount of sample effort appropriate for each unit. A brief description of each surveyed park unit is given below; listed acreages for park units were determined after Hurricane Katrina and do not include submerged land managed by the NPS. Park unit morphometrics were provided by Riley Hoggard of the Division of Science and Resource Management, GUIS and were the most current information as of June 2007. Figure 1 shows the locations of park units in the Mississippi District and Figure 2 shows park unit locations in the Florida District.

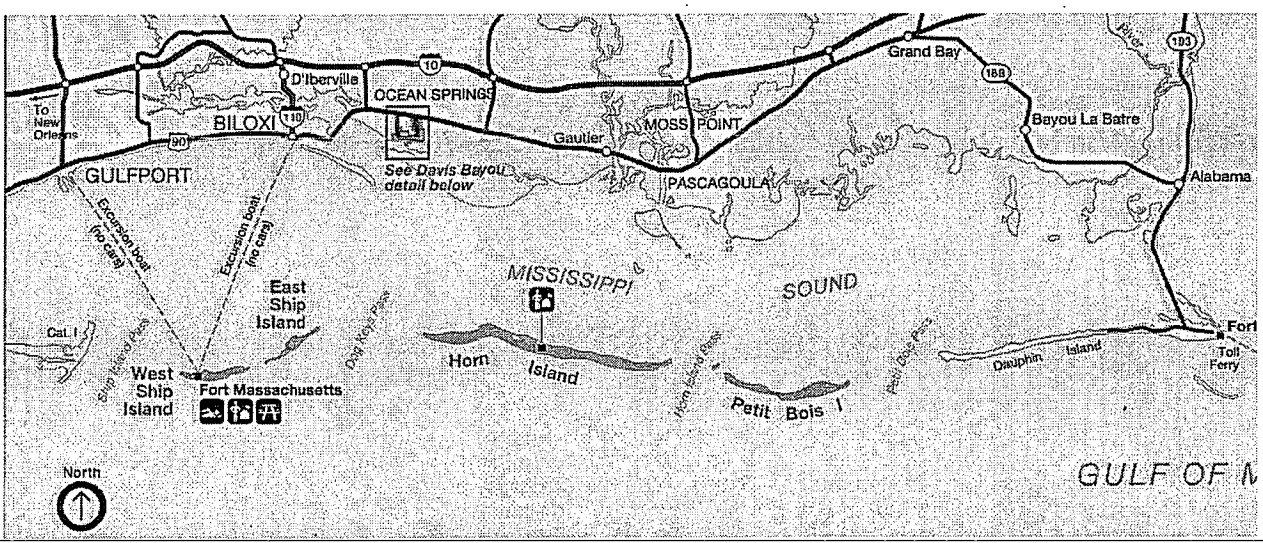

Figure 1: Mississippi District map.

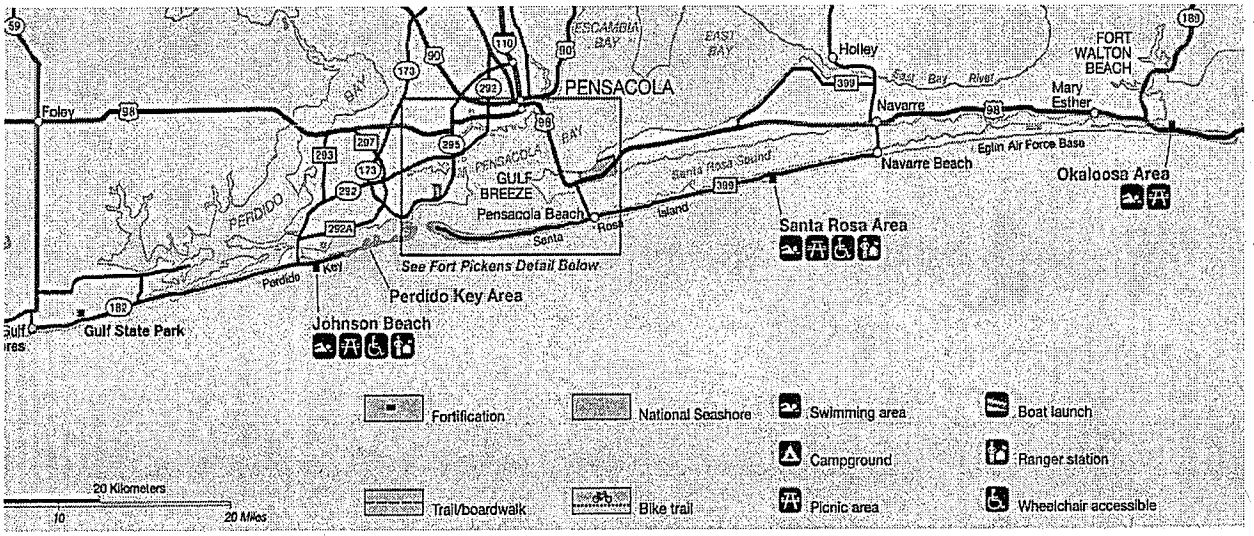

Figure 2: Florida District map.

Davis Bayou

Davis Bayou is unique in the Mississippi District because it is the only mainland unit, with coastal habitats that are not found on the Mississippi Barrier Islands. Davis Bayou was considered a priority site due to its size and complexity of habitats.

Formerly Magnolia State Park, Davis Bayou (Figure 3) is the Mississippi District headquarters and a primary location for visitor contact. Public facilities in Davis Bayou include a 52 site campground, ruderal fields, public boat launch, several large picnic pavilions, and restroom facilities. The park unit also has a government pier, several administrative office buildings and a large maintenance compound. A main road, Park Road, connects the unit to Highway 90 at its entrance and several residential roads branch off from the main park road. Davis Bayou is bordered on several sides by housing developments.

Contained within its 401 acres, Davis Bayou's habitats include: pine savanna, bayhead swamp, maritime forest, transitional forest, mixed hardwood forest, wetpine flatwoods, tidal marshes, rurderal fields, and bayou. Six drift fences were installed in Davis Bayou sampling a

variety of the park unit's habitats: (1) transitional forest and tidal marsh, (2) mixed hardwood and bayhead swamp, (3) wetpine flatwoods and pine savanna, (4) maritime forest and development, (5) wet pine flatwoods and development, and (6) mixed hardwood forest. Three transects of 20 cover boards were placed in areas sampling: (1) pine savanna and wetpine flatwoods, (2) bayhead swamp, and (3) mixed hardwood forest. Finally, PVC pipes were located at the park entrance ponds, savanna along Park Road, alligator pond, and the transitional forest between Eagle Point Road and the Government Docks.

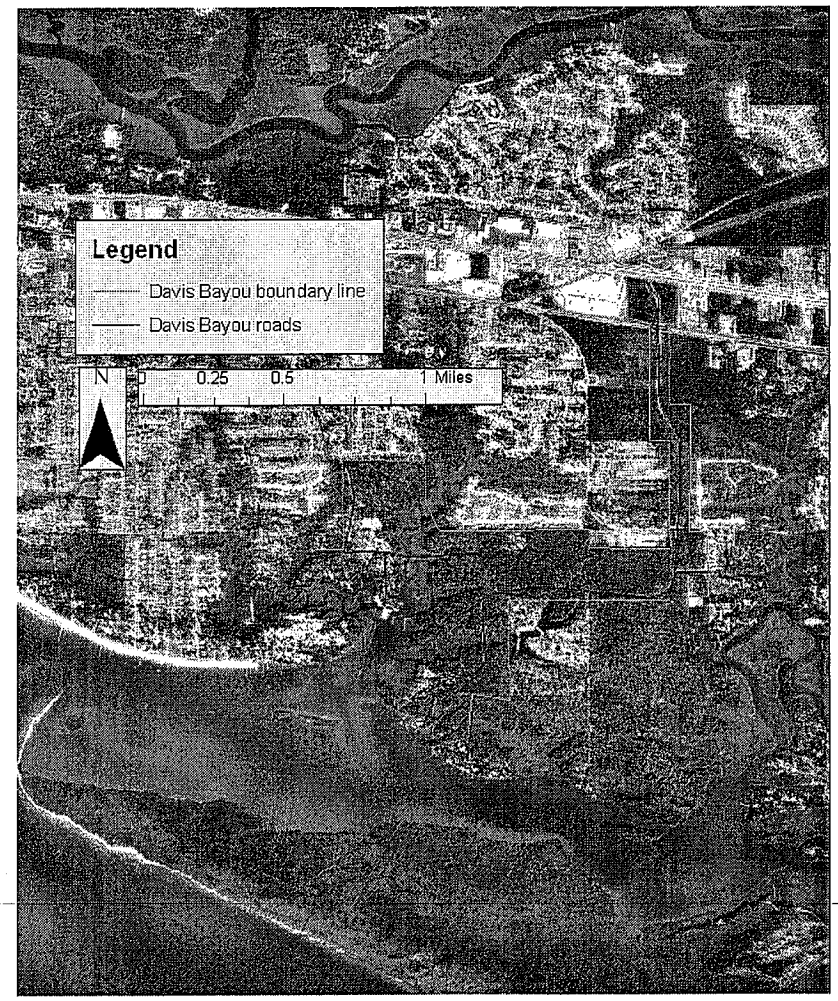

Figure 3: Arial photograph of Davis Bayou.

Cat Island

Cat Island is both the westernmost park unit in GUIS and westernmost barrier island in Mississippi. In 2004, the NPS acquired 687 acres of the island (total acreage: approximately 2,150 acres). In contrast to the other Mississippi barrier islands in the District, Cat Island does not have an east/west linear shape. Instead, it is shaped along a north/south axis with a major and a minor spit that both form in the western direction (Figure 4). Cat Island has the widest diversity of habitats of the Mississippi barrier islands (personal observation). There is a fairly large protected interior with abundant freshwater sources. The island is dominated by the live oak and slash pine community first described by Penfound and O'Neil in 1934. However, the "conspicuous and often almost impenetrable understory" they describe has likely been thinned out due to the introduction of axis deer and periodic development that has occurred on the island since their report. Herbaceous plants were sporadic in the interior forests and a deer browse line was present. On subsequent visits to the island since hurricane Katrina, a die off of some pine trees and an overgrowth of herbaceous plants has occurred; this is likely due to openings in the tree canopy and deer mortality. Freshwater is available throughout the island in interior marshes, small ponds, and abandoned manmade pools. It should also be noted that the soil had an organic surface layer in a few locations that was one half inch deep. Cat Island was considered a priority site due to a lack of previous documentation, relative large area, and complexity of habitats.

One season of sampling was conducted due to time and resource limitations. Semi-permanent sampling arrays were distributed to maximize sampling effort. All sampling gear was clearly identified with NPS and USM signage and located well within the NPS boundary. Six drift fences were set, each sampling a different island habitat. These habitats include: (1) saw palmetto/live oak relic dune, (2) open canopy/relic dune ridge, (3) ATV/small vehicle trail edge,

(4) ridge between wetlands, (5) maritime forest edge, and (6) pine dominated forest area. We distributed over 80 wooden cover boards in areas around and between drift fences and we placed three PVC pipe sampling arrays near small ponds, freshwater wetlands and forested areas adjacent to wetlands and ponds.

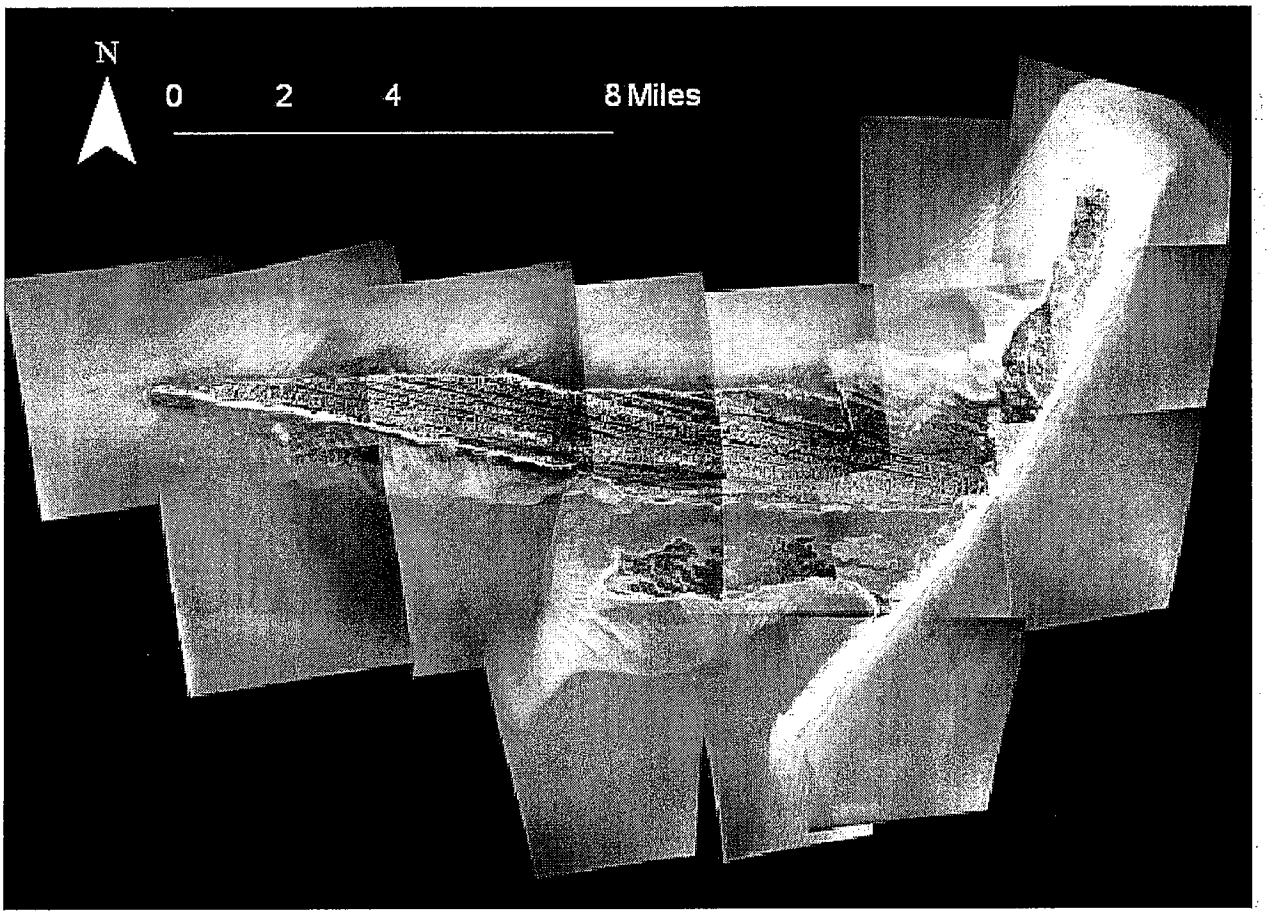

Figure 4: Cat Island, Mississippi, 2003.

West Ship Island

In 1969, West Ship Island (555 acres) was formed after Hurricane Camille cut a channel through Ship Island. West Ship is the most visited of the Gulf Islands and is serviced by a public ferry service that runs out of Gulfport, Mississippi nine months out of the year. West Ship has

several structures that are maintained by the NPS to support public visitation. An American Civil War era fortification, Fort Massachusetts, is located on the island and is a major tourist attraction.

The island contains several habitats typical to Gulf coast barrier islands. Primary sand dunes cover the north beach of the island and are vegetated with beach grasses and sea oats (*Uniola paniculata*). Moving inland, land is covered by a dune shrub zone filled with thick woody plants. The interior of the island is dominated by large black needlerush (*Juncus roemerianus*) marshes and connected ponds. Over the course of our survey, these wetlands changed from fresh water to brackish water following the storm surge of Hurricane Katrina. We observed these major changes in the island's wetlands once during the survey period and it is probable that this is a fairly common occurrence when large storms over-wash the island. There are no forested areas on the island; two small pine tree stands existed prior to Hurricane Katrina. We initially installed three drift fences to cover the major habitats of the island prior to Hurricane Katrina. Although these fence arrays were sufficient for a two year survey of the island, we later added three additional fences when conducting our post-Katrina survey in 2006. Habitats covered by these drift fences included: (1) brackish water wetland, (2) dune ridge between wetlands, and (3) the pine stands. Three cover board arrays were distributed between drift fences, each with ten metal and ten wood boards. One PVC pipe array was set along the edge of the island's largest marsh. West Ship Island was considered a priority site based on the amount of previous documentation and complexity of habitats.

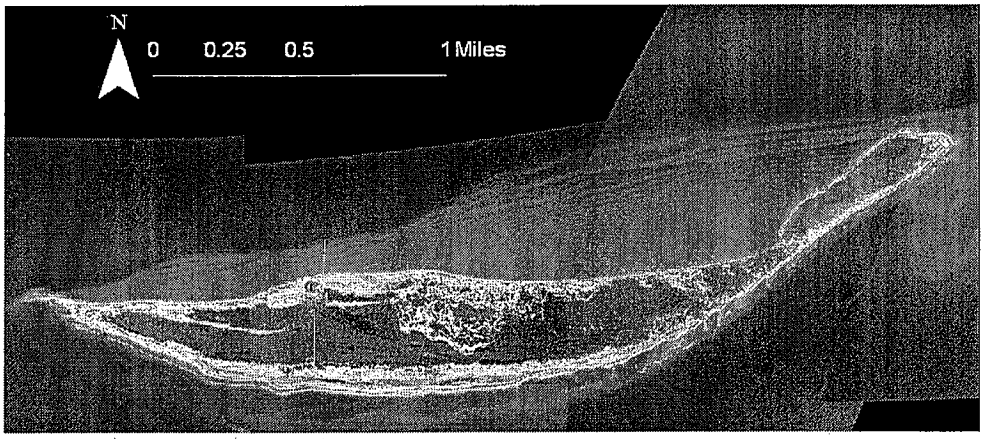

Figure 5: West Ship Island, Mississippi, 2003.

East Ship Island

With its remaining 362 acres, East Ship Island is the smaller half of old Ship Island. Prior to 2006, the interior of the island was dominated by a thick pine and live oak forest with several large ponds that were formed by storm wash-overs. These large ponds varied in salinity, however their close position to the north beach would facilitate frequent inundation of salt water. The only permanent source of freshwater on the island was a deep wallow (presumably formed by alligators) with a very small surface area.

Hurricanes Ivan (2004) and Katrina (2005) drastically altered this island, which today consists of only a live oak forest without any living pine trees. No permanent freshwater sources exist on the island and rainwater pools are only temporary puddles that may last for a day or two. Large sand flats on the eastern and western thirds of the island were washed out by Hurricanes Ivan and Katrina, leaving only the forested center of the island.

Three drift fences were placed on the island, each sampling at a different location in the maritime forest. Three cover board arrays were placed on the island between fences. East Ship Island was considered a priority site based on the amount of previous documentation and

complexity of habitats.

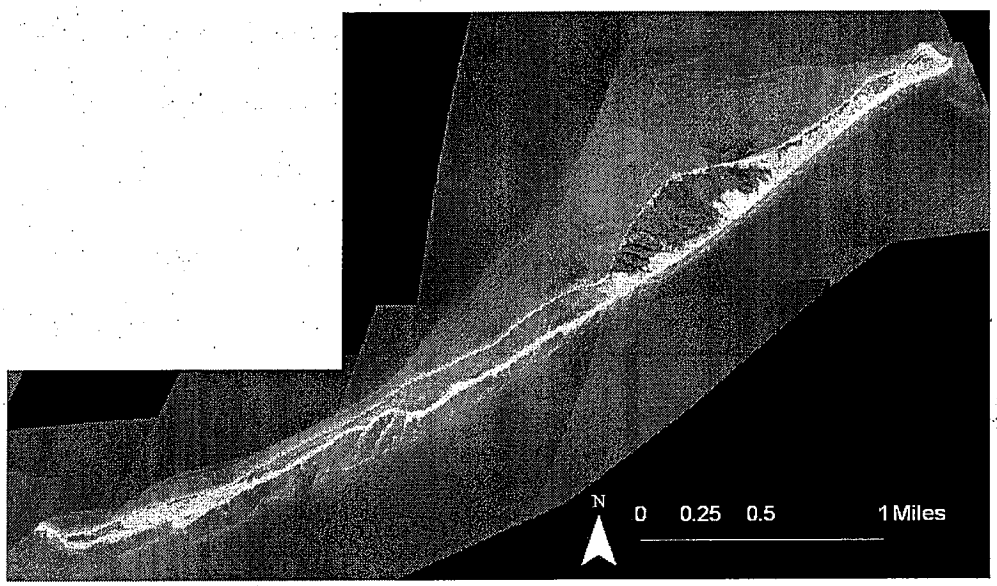

Figure 6: East Ship Island, Mississippi, 2003.

Horn Island

Horn Island is the largest of the Mississippi Gulf Islands with 3,650 acres, and is the longest at 13 miles. As described in Eleuterius 1979, Horn Island has a variety of habitats that include marsh, high marsh meadow, beach and relic dune ridges, maritime forest, lagoons and ponds. It was not considered to be a priority site because its herpetofaunal community was well documented in 1996 by Seigel and Doody. We set up one drift fence south of a relic dune in the "horseshoe" area of the island.

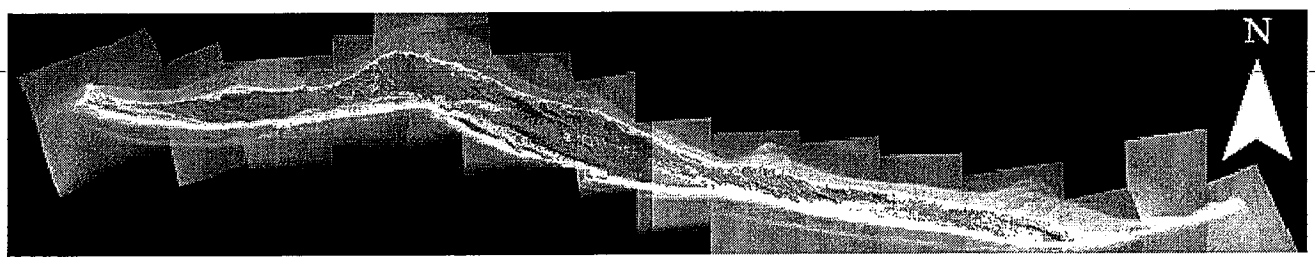

Figure 7: Horn Island, Mississippi, 2003.

Petit Bois Island

Petit Bois Island is the easternmost island in the Mississippi District. It currently measures 6.5 miles long and has an area of 1,466 acres. Only the east end of the island is forested, dominated by pine trees. As with the other islands in the District, many of this island's trees died after Hurricane Katrina; however, young pine trees can be found sporadically in the forest interior. Other habitats on the island include marshes, high marsh meadows, beach and relic dune ridges, and small ponds or pools that retain fresh rainwater.

Four drift fences were installed on the island: three that sampled throughout the forested area and one that sampled on a relic dune ridge adjacent to a marsh. Two PVC pipe arrays and three cover board arrays each with ten metal and ten wood boards sampled relic dune and maritime forest habitats. Petit Bois Island was considered a priority site based on area, the amount of previous documentation and complexity of habitats.

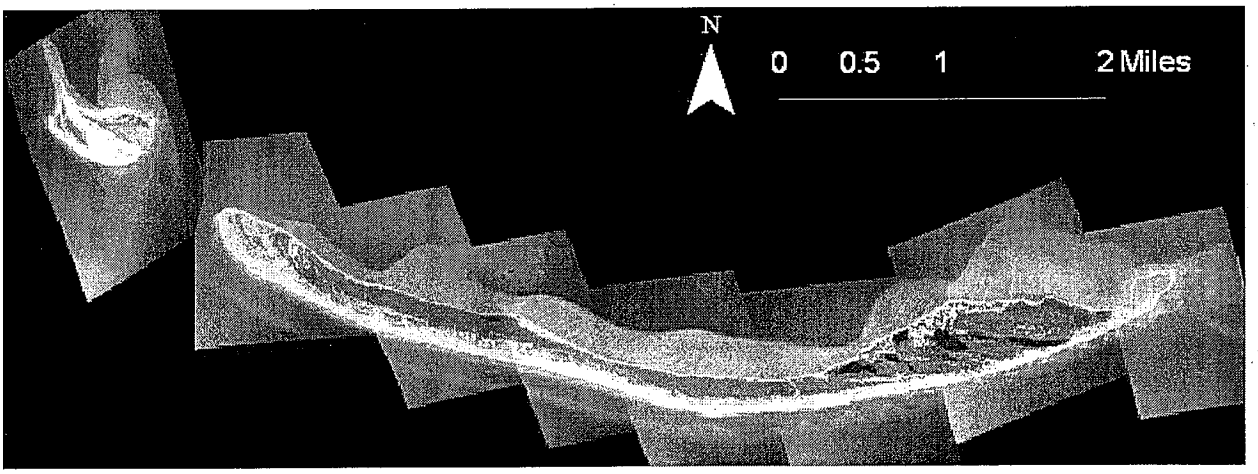

Figure 8: Petit Bois Island, Mississippi, 2003.

Perdido Key

Perdido Key is a long narrow park unit just southwest of Pensacola, Florida approximately nine miles long with 1,041 acres of land. Sampling of this unit has concentrated

on two forested areas located on the east and west ends of the park land. Parking lots and a small complex of NPS buildings are concentrated on the western end of the park unit. Additionally, large condominium high rises are present immediately outside the western park border. The eastern end of Perdido Key has a small bay that is a popular place for boaters to anchor and come ashore to the beach. Concrete ruins of Fort McRee and deep borrow pits are also present on the eastern end.

Three drift fences were installed in this park unit. One was placed in a forested area on the western end, and the other two fences were placed on the eastern tip. Additionally, two sets of 20 cover boards were placed at each end of the park unit. Perdido Key was considered a priority site based area, previous documentation, and complexity of habitats.

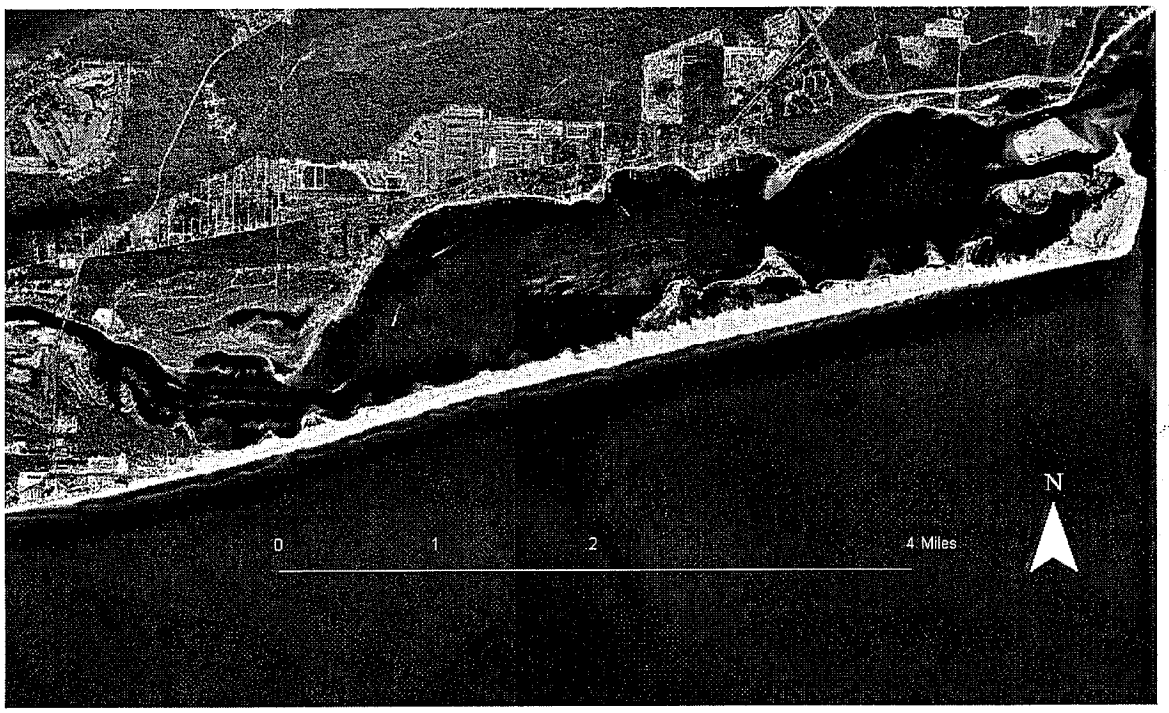

Figure 9: Aerial photograph of Perdido Key, Florida, 1999.

Fort Pickens

Fort Pickens is a park unit with several aquatic and terrestrial habitats. When open to the public Fort Pickens's proximity to Pensacola Beach encourages heavily visitation by campers and tourists. Several historic ruins are present in the park, which attract a number of visitors. There are over five different campground sites that accommodate both tent and vehicular camping in addition to a large fishing pier on the northwest bank. Fort Pickens was not designated a priority site based on the amount of previous documentation by Seigel, et al. No organized sampling was conducted in Fort Pickens except for some active searching that was conducted while field teams stayed in the campground.

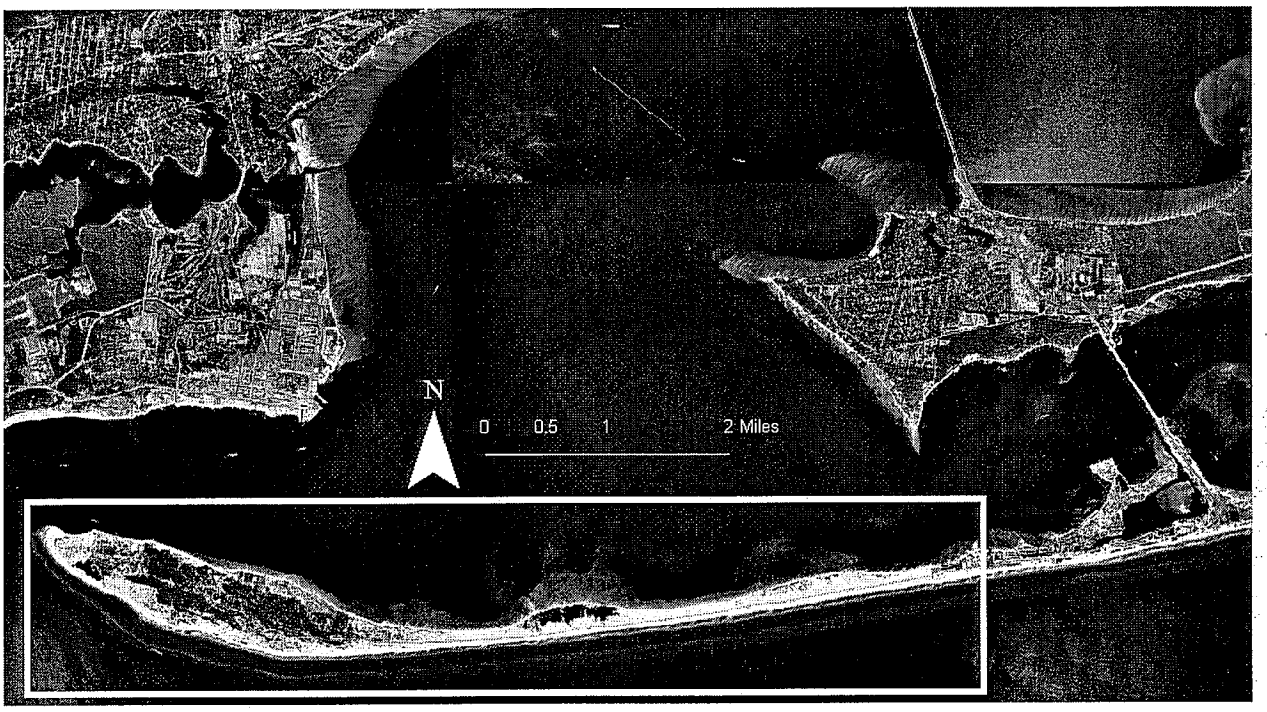

Figure 10: Aerial photograph outlining Fort Pickens, Florida, 1999.

Naval Live Oaks

Naval Live Oaks is the headquarters for the Florida District of GUIS. In its 1,378 acres, this park unit contains Florida scrub habitat, dune ridges, numerous permanent freshwater

sources and wetlands, buildings, parking lots and other anthropogenically disturbed areas. Due to prior survey work, Naval Live Oaks was not considered a priority sample site and received very little sampling attention. It should be noted that the work of Seigel and Doody found 43 unique species in this park unit.

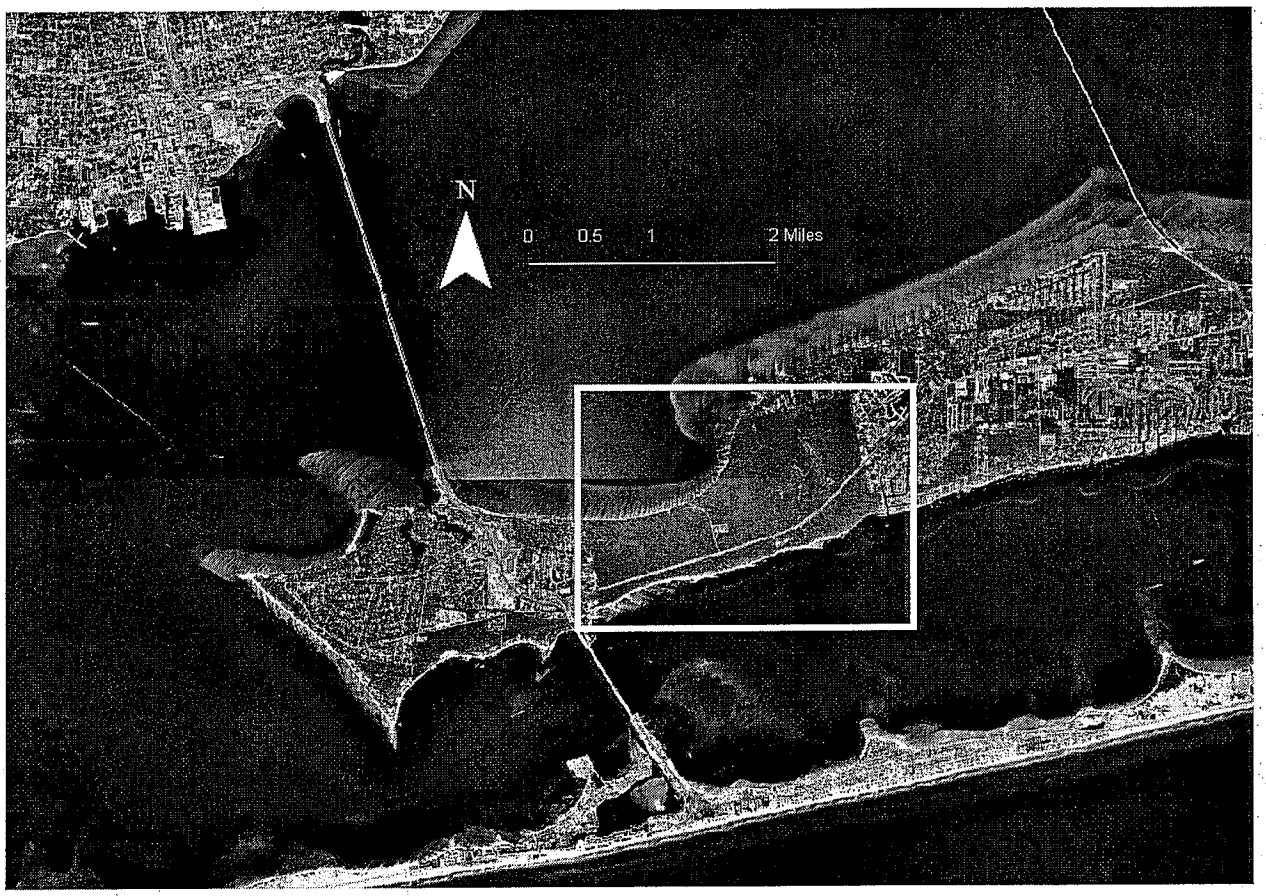

Figure 11: Aerial photograph outlining Naval Live Oaks, Florida, 1999.

Santa Rosa Island

Covering 1,598 acres and approximately eight miles of length, Santa Rosa Island consists of very large sand dunes with scattered forested areas. These forested areas typically include fresh water ponds and wetlands created by storm over-washes later re-filled with rainwater. This park unit is connected to the mainland by way of causeways originating from Gulf Breeze

and Navarre, Florida. The unit is accessible by way of the J. Earl Bowden Way road which runs through the entire length of this unit. Prior to Hurricane Ivan the J. Earl Bowden Way had several public picnic areas, NPS buildings, and beach access points for public and park usage. At the time of this report park buildings and the road had yet to be repaired and or replaced after the damaging storms from the 2005 hurricane season. Wilderness areas in Santa Rosa were easily accessible via J. Earl Bowden Way, however no visitors were seen in the unit's wooded areas.

Two drift fences were installed, each near large wooded areas and fresh water. Three sets of 20 cover boards were placed in areas surrounding the drift fences, and three PVC pipe arrays were installed. Santa Rosa Island was considered a priority site based on area, previous documentation, and complexity of habitats.

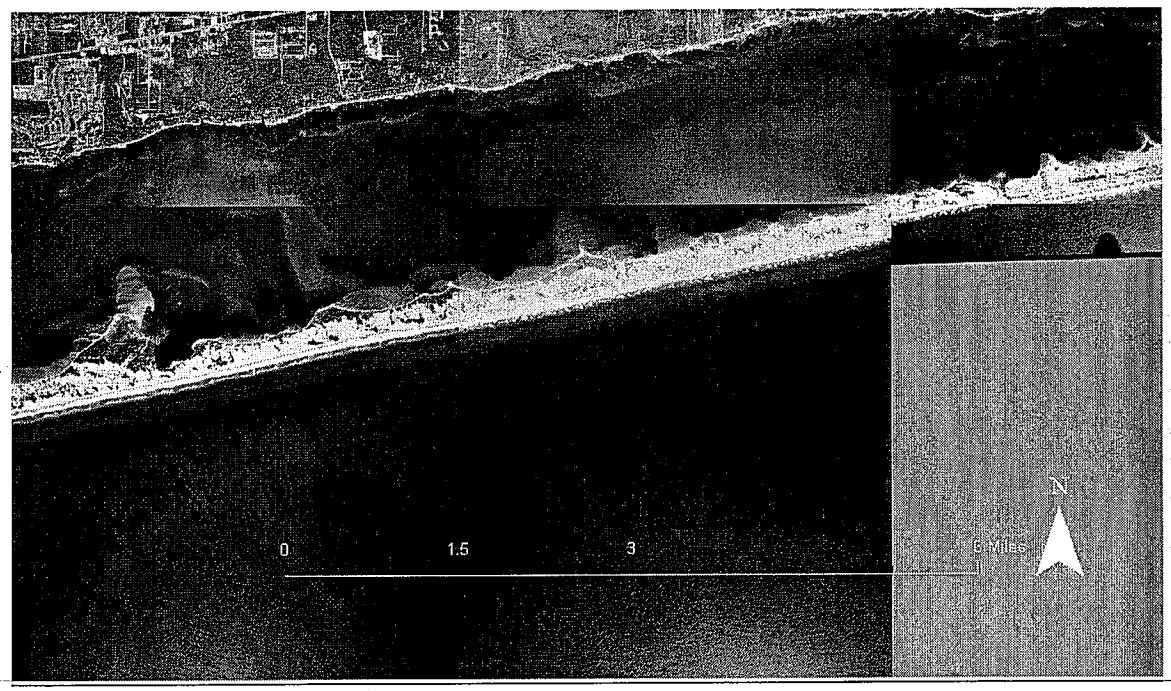

Figure 12: Aerial photograph of Santa Rosa Island, Florida, 1999.

Okaloosa

Okaloosa is a small area, 19 acres in size, located north of Highway 90. It is open to the public and visited primarily for use of its boat ramp and small public beach. There is also a public restroom and a paved area to accommodate the use of RVs by NPS volunteers. Natural areas in Okaloosa are limited to a small area of dunes and pine trees between Highway 90 to the south and the park driveway to the north. Additionally, Okaloosa shares a boundary with the Eglin Air Force Base. Okaloosa was not considered a priority site due to it small size and paucity of natural habitats, however undocumented species from adjacent Eglin Air Force Base may utilize Okaloosa and be found in the future.

OVERVIEW OF RESULTS

2004 Survey

A total of 46 unique taxa were documented in GUIS over the first year of sampling, including 17 species of amphibians and 29 species of reptiles. Surveys were concentrated on Santa Rosa Island, Perdido Key, Petit Bois Island, East Ship Island, West Ship Island and Davis Bayou. Table 8 details the species found at each park unit and the year(s) documented. Also in 2004, Hurricane Ivan (Category 3) made landfall on September 16, just west of the Florida District. Sampling was completed for the Florida District at the time Ivan hit so there was no interruption to sampling.

2005 Survey

Sampling in 2005 was a continuation of the herpetofaunal survey started in 2004. An additional nine new taxa were added to the list of herpetofauna documented by this survey (Table 8). Cat Island was added as a sampling site in the Mississippi District; we identified 13

taxa on the island. There were some logistical difficulties in sampling in the Florida District due to impacts of Hurricane Ivan the year before, however we completed our survey of GUIS.

2006 Survey

Sampling conducted in 2006 focused on identifying the initial effects of Hurricane Katrina on herpetofaunal communities in the Mississippi District. Surveys for herpetofauna were concentrated in Davis Bayou, West Ship Island, East Ship Island, and Petit Bois Island. In Davis Bayou, 30 taxa were documented after Katrina compared to 44 taxa documented prior to the storm. Only five taxa were found on the surveyed islands where there were 14 documented in the prior years of the survey.

2007 Observations

Observations made in 2007 were not the result of a dedicated survey but rather reliable reports from NPS personnel and project personnel taken after the survey. Two species were added to District taxa lists. The eastern glass lizard, *Ophisaurus ventralis,* was added to the Davis Bayou list, and the chicken turtle, *Deirochelys reticularia*, was added to the Fort Pickens taxa list.

Total Species

A total of 51 unique taxa were detected in GUIS over the course of this survey. Species documented by this survey are shown in Table 8 by park unit and the year they were detected.

Table 8: Herpetofaunal species detected in this survey by park unit and year documented.

Species	Common name	Year(s) Documented			
Davis Bayou (45 taxa)					
Amphiuma means	two-toed amphiuma	2004	2005	2006	
Eurycea quadridigitata	dwarf salamander	2004	2005		
Plethodon mississippi	slimy salamander	2004	2005	2006	
Acris gryllus gryllus	southern cricket frog	2004	2005	2006	2007
Bufo quercicus	oak toad		2005		

Bufo terrestris	southern toad	2004	2005	2006	2007
Gastrophryne carolinensis	eastern narrowmouth toad	2004	2005	2006	2007
Hyla cinerea	green treefrog	2004	2005	2006	2007
Hyla femoralis	pinewoods treefrog		2005		
Hyla gratiosa	barking treefrog	2004	2005		
Hyla squirella	squirrel treefrog	2004	2005	2006	2007
Hyla versicolor	gray treefrog	2004	2005	2006	
Pseudacris crucifer	spring peeper	2004	2005	2006	2007
Pseudacris nigrita nigrita	southern chorus frog		2005		
Rana catesbeiana	bullfrog	2004	2005	2006	
Rana clamitans clamitans	bronze frog	2004	2005	2006	2007
Rana grylio	pig frog	2004	2005	2006	
Rana sphenocephala	southern leopard frog		2005	2006	
Alligator mississippiensis	American alligator	2004	2005	2006	2007
Chelydra serpentina	snapping turtle	2004		2006	
Deirochelys reticularia	chicken turtle	2004			
Gopherus polyphemus	gopher tortoise			2005	
Kinosternon subrubrum	mud turtle	2004	2005	2006	
Malaclemys terrapin pileata	MS diamondback terrapin		2005	2006	
Terrapene carolina	box turtle	2004	2005	2006	2007
Trachemys scripta elegans	red eared slider	2004	2005	2006	2007
Anolis carolinensis	green anole	2004	2005	2006	2007
Eumeces inexpectatus	SE five-lined skink	2004	2005	2006	2007
Eumeces laticeps	broadhead skink	2004	2005		
Hemidactylus turcicus	Mediterranean gecko	2004	2005	2006	
Ophisaurus ventralis	eastern glass lizard				2007
Scincella lateralis	ground skink	2004	2005		2007
Agkistrodon piscivorus	cottonmouth	2004	2005	2006	
Cemophora coccinea	scarlet snake		2005		
Coluber constrictor priapus	southern black racer	2004	2005	2006	2007
Elaphe guttata guttata	corn snake		2005		
Elaphe obsoleta	rat snake	2004	2005	2006	
Diadophis punctatus punctatus	southern ringneck snake		2005		
Lampropeltis getulus holbrooki	speckled kingsnake	2004	2005	2006	
Nerodia clarkii clarkii	Gulf salt marsh snake	2004	2005	2006	
Nerodia cyclopion	MS green water snake		2005	2006	
Nerodia fasciata fasciata	banded water snake		2005	2006	
Opheodrys aestivus	rough green snake	2004			2007
Tantilla coronata	SE crowned snake	2004		2006	
Thamnophis sauritus sauritus	eastern ribbon snake	2004			2007

Cat Island (13 taxa)

Gastrophryne carolinensis	eastern narrowmouth toad		2005		
Hyla cinerea	green treefrog		2005		
Hyla squirella	squirrel treefrog		2005		
Rana sphenocephala	southern leopard frog		2005		

Alligator mississippiensis	American alligator		2005		
Anolis carolinensis	green anole		2005		
Cnemidophorus sexlineatus	six-lined racerunner		2005		
Eumeces inexpectatus	SE five-lined skink		2005		
Scincella lateralis	ground skink		2005		
Coluber constrictor latrunculus	black masked racer		2005		
Elaphe obsoleta lindheimerii	Texas rat snake		2005		
Thamnophis sauritus sauritus	eastern ribbon snake		2005		
Thamnophis sirtalis sirtalis	eastern garter snake		2005		
West Ship Island (12 taxa)					
Rana sphenocephala	southern leopard frog	2004	2005		
Alligator mississippiensis	American alligator	2004	2005		
Malaclemys terrapin pileata	MS diamondback terrapin			2006	
Cnemidophorus sexlineatus	six-lined racerunner	2004	2005		2007
Anolis carolinensis	green anole			2006	
Scincella lateralis	ground skink	2004			
Coluber constrictor latrunculus	black masked racer	2004	2005		
Lampropeltis getulus holbrooki	speckled kingsnake		2005		
Nerodia clarkii clarkii	Gulf salt marsh snake		2005	2006	
Nerodia cyclopion	MS green water snake	2004	2005	2006	
Nerodia fasciata confluens	broad-banded water snake	2004			
Thamnophis sirtalis sirtalis	eastern garter snake	2004			
East Ship Island (6 taxa)					
Alligator mississippiensis	American alligator	2004	2005		
Malaclemys terrapin pileata	MS diamondback terrapin			2006	
Anolis carolinensis	green anole	2004			
Cnemidophorus sexlineatus	six-lined racerunner	2004			
Agkistrodon piscivorus	cottonmouth	2004			
Nerodia clarkii clarkii	Gulf salt marsh snake	2004		2006	
Horn Island (10 taxa)					
Hyla squirella	squirrel treefrog	2004	2005		2007
Rana sphenocephala	southern leopard frog		2005		
Alligator mississippiensis	American alligator		2005		2007
Malaclemys terrapin pileata	MS diamondback terrapin		2005		
Anolis carolinensis	green anole	2004			
Cnemidophorus sexlineatus	six-lined racerunner				2007
Scincella lateralis	ground skink	2004			
Agkistrodon piscivorus	cottonmouth				2007
Coluber constrictor	black racer				2007
Nerodia clarkii clarkii	Gulf salt marsh snake			2006	

Petit Bois Island (16 taxa)

Hyla cinerea	green treefrog	2004	2005		
Hyla squirella	squirrel treefrog	2004	2005		
Rana sphenocephala	southern leopard frog	2004			
Alligator mississippiensis	American alligator	2004	2005		
Anolis carolinensis	green anole	2004			
Cnemidophorus sexlineatus	six-lined racerunner	2004	2005	2006	2007
Ophisaurus ventralis	eastern glass lizard		2005		
Agkistrodon piscivorus	cottonmouth		2005		
Coluber constrictor latrunculus	black masked racer	2004			
Coluber constrictor priapus	southern black racer		2005		
Lampropeltis getulus holbrooki	speckled kingsnake	2004			
Masticophis flagellum flagellum	eastern coachwhip		2005		
Nerodia clarkii clarkii	Gulf salt marsh snake			2006	
Nerodia cyclopion	MS green water snake	2004			
Nerodia fasciata fasciata	banded water snake	2004			
Thamnophis s. sauritus	eastern ribbon snake	2004			

Perdido Key (13 taxa)

Bufo quercicus	oak toad	2004			
Gastrophryne carolinensis	eastern narrowmouth toad	2004			
Hyla cinerea	green treefrog	2004			
Hyla squirella	squirrel treefrog	2004	2005		
Rana sphenocephala	southern leopard frog	2004	2005		
Kinosternon subrubrum	mud turtle	2004			
Terrapene carolina major	Gulf Coast box turtle	2004			
Anolis carolinensis	green anole	2004			
Cnemidophorus sexlineatus	six-lined racerunner	2004	2005		
Hemidactylus turcicus	Mediterranean gecko	2004			
Ophisaurus ventralis	eastern glass lizard	2004			
Scincella lateralis	ground skink	2004			
Agkistrodon piscivorus	cottonmouth	2004			

Fort Pickens (10 taxa)

Hyla cinerea	green treefrog	2004			
Hyla squirella	squirrel treefrog	2004			
Alligator mississippiensis	American alligator	2004			2007
Deirochelys reticularia	chicken turtle				2007
Anolis carolinensis	green anole	2004			
Cnemidophorus sexlineatus	six-lined racerunner	2004			2007
Hemidactylus turcicus	Mediterranean gecko	2004			
Ophisaurus sp.	glass lizard	2004			
Nerodia fasciata fasciata	banded water snake	2004			
Thamnophis sauritus sauritus	eastern ribbon snake	2004			

Santa Rosa Island (14 taxa)

Bufo terrestris	southern toad	2004	2005
Gastrophryne carolinensis	eastern narrowmouth toad	2004	2005
Hyla cinerea	green treefrog	2004	
Hyla squirella	squirrel treefrog	2004	2005
Rana sphenocephala	southern leopard frog	2004	2005
Kinosternon subrubrum	mud turtle	2004	
Anolis carolinensis	green anole	2004	
Cnemidophorus sexlineatus	six-lined racerunner	2004	2005
Hemidactylus turcicus	Mediterranean gecko	2004	
Agkistrodon piscivorus	cottonmouth	2004	2005
Coluber constrictor priapus	southern black racer	2004	
Masticophis flagellum flagellum	eastern coachwhip	2004	2005
Nerodia ffasciata fasciata	banded water snake	2004	
Hemidactylus turcicus	Mediterranean gecko	2004	

Naval Live Oaks (15 taxa)

Acris gryllus gryllus	southern cricket frog		2005
Eleutherodactylus planirostris	greenhouse frog	2004	
Bufo terrestris	southern toad	2004	
Hyla squirella	squirrel treefrog	2004	
Hyla femoralis	pinewoods treefrog		2005
Rana clamitans clamitans	bronze frog		2005
Rana grylio	pig frog		2005
Anolis carolinensis	green anole		2005
Cnemidophorus sexlineatus	six-lined racerunner		2005
Eumeces laticeps	broadhead skink	2004	2005
Ophisaurus ventralis	eastern glass lizard		2005
Hemidactylus turcicus	Mediterranean gecko		2005
Sceloporus undulatus	fence lizard		2005
Scincella lateralis	ground skink	2004	
Coluber constrictor priapus	southern black racer		2005

Okaloosa (5 taxa)

Bufo terrestris	southern toad	2004	2005
Gastrophryne carolinensis	eastern narrowmouth toad	2004	2005
Hyla squirella	squirrel treefrog	2004	2005
Anolis carolinensis	green anole	2004	
Cnemidophorus sexlineatus	six-lined racerunner	2004	

Work Effort

A summary of sampling effort for each year is given in Table 9. We sampled 170 days over the course of this three year survey. We conducted a total of 1,290 manual search hours, including 163 hours dedicated to frog call surveys. Drift fences were in operation for a total of 202 trap days and minnow traps were used for 1,494 trap days.

	Sample Days	Drift Fence Days	Minnow Trap Days	Turtle Trap Days	Manual Search Hours	Call Survey Hours
Davis Bayou	16	17	339	41	217	24
West Ship Island	11	7	117	0	92	6
East Ship Island	6	5	41	0	24	4
Petit Bois	4	4	54	0	35	6
Perdido Key	5	3	0	0	33	6
Fort Pickens	9	0	9	0	26	6
Santa Rosa	10	8	80	0	74	4
Navel Live Oaks	1	0	0	0	4	0
Okaloosa	1	0	0	0	8	0
Total 2004	**63 Days**	**44 Days**	**640 Days**	**41 Days**	**513 Man-hours**	**56 Man-hours**
Cat Island	10	14	60	0	47	9
Davis Bayou	19	16	104	3	156	23
West Ship Island	10	13	45	0	46	6
East Ship Island	3	0	52	0	32	3
Horn Island	4	2	0	0	41	3
Petit Bois	8	4	68	0	34	8
Perdido Key	3	0	0	0	9	0
Santa Rosa	8	10	35	0	33	6
Navel Live Oaks	5	0	0	0	6	5
Okaloosa	1	0	0	0	4	2
Total 2005	**71 Days**	**53 Days**	**364 Days**	**3 Days**	**408 Man-hours**	**65 Man-hours**
Davis Bayou	18	55	228	12	159	26
West Ship Island	7	20	114	0	84	8
East Ship Island	5	0	40	0	34	5
Petit Bois Island	6	30	108	0	92	3
Total 2006	**36 Days**	**105 Days**	**490 Days**	**12 Days**	**369 Man-hours**	**42 Man-hours**
Overall Totals	**170 Days**	**202 Days**	**1494 Days**	**56 Days**	**1290 Man-hours**	**163 Man-hours**

Table 9: Total work effort by park unit and year.

INVASIVE AND POTENTIALLY INVASIVE SPECIES

Two exotic species were found currently occurring in GUIS: the greenhouse frog (*Eleutherodactylus planirostris*) and the Mediterranean gecko (*Hemidactylus turcicus turcicus*). Historical records were found for the Texas horned lizard (*Phrynosoma cornutum*) in the vicinity of NPS property in the Florida District. The brown anole (*Anolis sagrei*) is an introduction risk, but has not yet been identified as occurring in GUIS.

Eleutherodactylus planirostris

The greenhouse frog (*Eleutherodactylus planirostris*) is a tiny terrestrial frog that was likely introduced from Cuba. It is widespread in peninsular Florida, New Orleans and documented sporadically in the Florida panhandle (Conant 1998). According to the Florida Museum of Natural History, the first state record of the frog was in 1875 and the species has maintained breeding status in the state for at least the last ten years. The frog was documented at Eglin Air Force Base (Okaloosa County) in 1995 (Jensen 1995). Expansion of the frog's range is believed to be facilitated by the transportation of imported plants in the nursery industry (Dundee 1989).

Eleutherodactylus planirostris was identified at Naval Live Oaks (NLO) in 2005 by manual searching and vocal surveys. One voucher specimen was collected from the NLO Visitor's Center nature trail and used to confirm identification. The species was earlier identified to occur at GUIS following hurricanes Erin and Opal in 1995 (Seigel 1997). *Eleutherodactylus planirostris* has not been identified to occur in any other park units at this time, and likely has not spread due to the natural geologic barriers between the units. In Mississippi, the species has not been found in either Harrison or Jackson County, however due to its mode of distribution, it

would appear that introduction to these counties is probable. There is no published information on any detrimental effects this species may have on native fauna.

Hemidactylus turcicus

The Mediterranean gecko (*Hemidactylus turcicus*) has been documented by this survey in both the Florida and Mississippi Districts. The exotic species is well established and widespread in the southeastern United States (Conant 1998). In Florida, the species was documented in Okaloosa and Escambia counties in 1994 (Jensen 1995). Typically found on buildings and other manmade structures, it survives where it can find heat to survive the mild winters of the southeast. Voucher specimens were collect from the Davis Bayou Visitor's Center; it was also documented in Perdido Key, Fort Pickens, Naval Live Oaks, and the Okaloosa park unit. In Mississippi, it could to spread to the barrier islands via boat travel and transportation of building materials, equipment, and supplies. No negative impacts to local fauna have been documented and are likely insignificant since this species is primarily restricted to manmade structures.

Phrynosoma cornutum

The Texas horned lizard (*Phrynosoma cornutum*) was documented on Santa Rosa Island by Carr in 1940 and Jensen in 1994. Native from northern Mexico to Central U.S., the specimens that were found were undoubtedly released pets. Since no reports of the lizard have been made recently, or any found during our survey, it appears that *P. cornutum* is not currently in the Park. There are no known negative impacts to local herpetofauna caused by this species.

Anolis sagrei

The brown anole (*Anolis sagrei*), native to the West Indies, is similar in appearance to the native green anole (*Anolis carolinensis*). Identification between these two species can be difficult since green anoles have the ability to change to a brown color and blend in with

background objects. Green anoles are often found when they are brown in color but will eventually revert back to green. The easiest way to distinguish between the two species is via the color of the male's throat fan. Male brown anoles have an orange throat fan that they display in the breeding season, whereas the green anole has a prominent pink fan.

The range of brown anoles in the United States has been reported by Conant to include peninsular Florida, and isolated localities in southeast Texas. In Florida, the species has been reported in 52 counties, but not in Santa Rosa, Okaloosa or Escambia counties (FMNH). The Mississippi Museum of Natural Science has a specimen (6492) for Jackson County, which was collected from Ocean Springs by Pete Floyd in May 2000. According the record, the specimen was collected from an "apparently recently introduced population established at this nursery." Populations have been found along major highways at rest areas, campgrounds, and hotels and are likely being transported via motor vehicles (Campbell 1996). Additionally, Campbell reports populations occurring on dredge spoil islands, which anoles reach by riding on boats or on firewood piles transported on boats by campers. It is likely that populations of brown anoles will eventually become established and may enter into the mainland units of GUIS, and perhaps eventually to the Mississippi barrier islands.

If introduced to the park, brown anoles will likely have a negative impact on local herpetofaunal species especially green anoles. "Anecdotal and some experimental evidence suggest that the brown anole is primarily responsible for reduced numbers of green anoles, particularly in human-altered habitats" (FMNH). Brown anoles have been shown to displace green anoles higher into trees, and adult male brown anoles occasionally prey upon smaller green anoles (Gerber 1991). If populations become established in GUIS, it would be prudent to monitor both native and exotic lizards.

THREATENED AND ENDANGERED SPECIES

Effort was made to identify any species within GUIS that were listed as either state or federally Threatened or Endangered. Prior to field sampling, we made a thorough search of museum records and published accounts to identify previous documentation of these listed species. Additionally, the ranges described in field guides were used to determine which species could potentially occur in the park, excluding sea turtles. Once our survey was completed, the only listed herpetofaunal species found in GUIS were the American alligator (*Alligator mississippiensis*) and gopher tortoise (*Gopherus polyphemus*). *Alligator mississippiensis* is federally listed in parts of its range as "threatened due to similarity of appearance". *Gopherus polyphemus* is listed as federally threatened in parts of its range, and state endangered in Mississippi. A small colony of tortoises is located north of Highway 90 at the Naval Live Oaks unit. NPS Resource Management personnel annually monitor this population and it is well documented. As of 2006, surveys conducted by the NPS found 16 active burrows in Naval Live Oaks. Figure 13, provided by Mark Nicholes and produced by GUIS Science and Resource Management, shows burrow locations in Naval Live Oaks and also a relocation recipient site from 2002.

In addition to the Naval Live Oaks colony, a single adult tortoise was found in Davis Bayou. The tortoise was found wandering Park Road by park biologist Gary Hopkins, and was most likely released into the park by a well-meaning member of the general public. Follow-up surveys showed no signs of gopher tortoises or their burrows. Searches of historical records have no found mention of any gopher tortoise colonies in Davis Bayou.

Figure 13: Active gopher tortoise burrow locations, 2006. (Map courtesy of GUIS SR&M).

Sea turtles are also documented to occur in GUIS. As per this survey's scope of work, sea turtles were not included in this survey. Several species of sea turtles are documented to nest in the Florida District. In Mississippi, sea turtles have historically nested on the barrier islands and have been reported stranded or washed up dead. For more information on sea turtles in GUIS see Appendix B, "Bibliography," for published accounts of sea turtles in GUIS. Over the course of this survey we witnessed one dead loggerhead sea turtle, (*Caretta caretta*) on the north beach of West Ship Island in 2004. Additionally, after this survey in 2007, a dead leatherback sea turtle (*Dermochelys coriacea*) was found on the northwest tip of Petit Bois Island.

SPECIES OF SPECIAL CONCERN

In addition to the federal threatened and endangered species listings, many states, including Mississippi and Florida, have lists for species they consider to be of special concern or special interest. Prior to our survey, species in these categories were identified for Mississippi and Florida. In Mississippi, the Mississippi diamondback terrapin (*Malaclemys terrapin pileata*) and the Gulf salt marsh snake (*Nerodia clarkii clarkii*) are both ranked by the state's Natural Heritage Program (NHP) with a S2 rating. The Mississippi NHP S2 ranking designates a species as "imperiled in Mississippi because of rarity or because of some factor(s) making it vulnerable to extirpation." A search of historic records and personal communications show the 1957 documentation of a mud salamander (*Pseudotriton montanus*) and the occurrence of a rainbow snake (*Farancia erytrogramma*) in Davis Bayou. The mud salamander is listed by the Mississippi NHP as a S2/S3, which designates the species as "imperiled to rare or uncommon" and the rainbow snake as a S2.

In Florida, the American alligator (*Alligator mississippiensis*) was documented and the Pine Barrens treefrog (*Hyla andersonii*) was previously documented in GUIS. The alligator is listed as a SSC3 by the Florida Fish and Wildlife Conservation Commission, identifying that the species "may occupy such an unusually vital or essential ecological niche that should it decline significantly in numbers or distribution other species would be adversely affected to a significant degree" (Florida Wildlife Commission 2004). The Pine Barrens treefrog is designated with a SSC1 designation that includes species that "has a significant vulnerability to habitat modification, environmental alteration, human disturbance, or human exploitation which, in the foreseeable future, may result in its becoming a threatened species unless appropriate protective or management techniques are initiated or maintained" (Florida Wildlife Commission 2004).

Farancia erytrogramma

In Mississippi the rainbow snake (*Farancia erytrogramma*) is ranked by the Mississippi NHP as a S2 species, and is vulnerable to extirpation due to habitat loss and alteration. The last and only known observation of *Farancia erytrogramma* was made by Gary Hopkins of the Mississippi District Division of Science and Resource Management. Based on personal communications with Mr. Hopkins, a road killed rainbow snake was found on Park Road near the ponds at the entrance to Davis Bayou around 1985. This is an easily identifiable snake and the observation is considered credible.

Hyla andersonii

The Pine Barrens treefrog (*Hyla andersonii*) was documented in GUIS by Seigel et al following the hurricanes of 1995. The Pine Barrens tree frog has a highly disjunctive distribution that includes New Jersey, North and South Carolina, Alabama and the Florida Panhandle. It is easy to identify visually when captured and has a fairly distinct call.

Malaclemys terrapin pileata

The diamondback terrapin (*Malaclemys terrapin*) has a unique range that is restricted to salt and brackish waters of coastal wetlands along the Atlantic and Gulf coasts of North America. Seven sub-species of terrapin are recognized, including the Mississippi diamondback terrapin (*Malaclemys terrapin pileata*) whose range extends from western Louisiana to the Florida panhandle. Terrapin populations have been reported as declining rangewide. Numerous anthropogenic reasons have been documented for these declines, including: road mortality, by-catch in crab traps, and habitat destruction.

Nerodia clarkii clarkii

The Gulf salt marsh snake (*Nerodia clarkii clarkii)* is a cryptic aquatic snake inhabiting salt or brackish water habitats. The snake is easily distinguishable from other water snakes by lateral striping on the dorsal and ventral sides. In GUIS, individual variation was observed that included ventral color variation and dorsal pattern variation.

Surveys by Tom Mann in 1993-1994 yielded only one observation of a salt marsh snake in GUIS. Prior to Hurricane Katrina, only four specimens were identified in Mississippi at Davis Bayou and West Ship Island, however after the storm, 65 observations were recorded on West Ship Island, East Ship Island and Petit Bois Island and reliable reports from NPS personnel report their occurrence on Horn Island.

Pseudotriton montanus

The mud salamander was last collected by Denzel E. Ferguson in March, 1957, in Davis Bayou (then Magnolia State Park). Based on ranges described in Conant 1998, the sub-species for the individual would likely be the gulf coast mud salamander (*P. m. flavissimus*). According to Conant, this species occurs in muddy habitats and small streams, and often burrows into muck and may seek refuge in crayfish burrows. Because of its behavior and habitat preferences, it is a species that is difficult to detect. It is possible that the species remains undetected in the park, however due to the amount of time and thoroughness of our manual search efforts in appropriate areas, we feel that we would have detected if present.

SPECIES ACCOUNTS

The follow is a list of species accounts for all species documented in this survey. These accounts include the abundance of a given species within GUIS. Abundance categories are listed below as defined in Attachment A of the scope of work provided by the Gulf Coast Network's Biological Inventory:

> Abundant Animals: May be seen daily, in suitable habitat and season, and counted in relatively large numbers.
> Common Animals: May be seen daily, in suitable habitat and season, but not in large numbers.
> Uncommon Animals: Likely to be seen monthly in appropriate habitat and season. May be locally uncommon.
> Rare animals: Present, but usually seen only a few times a each year.
> Occasional Animals: Occurs in the park at least once every few years, but not necessarily every year.
> Unknown: Abundance unknown.

(1) *Amphiuma means* (two-toed amphiuma)
Taxonomic notes: none
Abundance: common
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Aquatic slow moving habitats and freshwater ponds.
Seasonality: Species was detected from March to October.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was captured by the use of un-baited round minnow traps.
General comments: Species was documented at Davis Bayou Entrance ponds, Visitor Center pond, Gator pond, Highway 90 right-of-way drainage ditch, small creeks associated with the North to South stretch of Park Road.

(2) *Eurycea quadridigitata* (dwarf salamander)
Taxonomic notes: none
Abundance: rare
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Bayhead swamp and mixed hardwood forest slopes.
Seasonality: Species was detected in early spring, March and April.

Voucher: Yes **Voucher type:** photo
Capture summary: Specimens were captured via active search and under wood cover boards.
General comments: Specimens were found at Gator Pond and on slopes near the CCC Trail.

(3) *Plethodon mississippi* (slimy salamander)
Taxonomic notes: Formerly, *Plethodon glutinosus*, thirteen species are currently recognized, distinguished by location within the *Plethodon* complex's range.
Abundance: common
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Wetpine flatwoods, pine savanna, mixed hardwood forest, often on dry slopes.
Seasonality: Species can be found throughout the year.

Voucher: Yes **Voucher type:** photo
Capture summary: Found under cover objects such as fallen trees and other debris, under cover boards, and in drift fence arrays.
General comments: Most commonly found salamander in GUIS.

(4) *Acris gryllus* (cricket frog)
Taxonomic notes: Sub-species in GUIS is *Acris gryllus gryllus*, the southern cricket frog.
Abundance: abundant
District(s): FL, MS **Park units documented**: Davis Bayou, Naval Live Oaks

Habitat associations: Bayhead swamps and permanent freshwater ponds and wetlands.
Seasonality: Species can be found throughout the year.

Voucher: Yes **Voucher type:** photo, audio and preserved specimen
Capture summary: Species was often hand caught when in appropriate habitats.
General comments: Gator pond in Davis Bayou is a breeding site for this species.

(5) *Bufo quercicus* (oak toad)
Taxonomic notes: none
Abundance: uncommon
District(s): FL, MS **Park units documented**: Davis Bayou and Perdido Key

Habitat associations: Pine savanna
Seasonality: Found in June and July

Voucher: Yes **Voucher type:** photo and preserved specimen
Capture summary: Species was detected by call surveys and captured in drift fence arrays.
General comments: Species is often as associated with fire dependent habitats. Specimens observed in Perdido Key had individual variation of color patterns that included bright red to dull grayish brown.

(6) *Bufo terrestris* (southern toad)
Taxonomic notes: none
Abundance: abundant
District(s): FL, MS **Park units documented**: Davis Bayou, Santa Rosa Island, Naval Live Oaks and Okaloosa Area.

Habitat associations: Permanent freshwater ponds and wetlands, buildings, high marsh meadow, beach and relic dune ridges, wetpine flatwoods, maritime forest, mixed hardwood forests, Florida scrub, and bay head swamps.

Seasonality: Species can be found throughout the year.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was detected by call surveys, captured by active search, drift fence arrays, and minnow traps. Most encountered species at GUIS.
General comments: Breeding areas identified include temporary freshwater swales throughout Santa Rosa Island, the Visitors Center pond and CCC Trail pond at Davis Bayou.

(7) *Eleutherodactylus planirostris* (greenhouse frog)
Taxonomic notes: none
Abundance: common
District(s): FL **Park units documented**: Naval Live Oaks

Habitat associations: Freshwater wetlands, mixed hardwood forest and disturbed areas.
Seasonality: Species was detected in May.

Voucher: Yes Voucher type: preserved specimen
Capture summary: Species was detected by call survey and active search.
General comments: This is a non-native frog that closely resembles members of the genus *Pseudacris.*

(8) *Gastrophryne carolinensis* (eastern narrowmouth toad)
Taxonomic notes: none
Abundance: abundant
District(s): FL, MS **Park units documented**: Cat Island, Davis Bayou, Perdido Key, Santa Rosa Island and Okaloosa Area.

Habitat associations: Freshwater ponds and pools, freshwater wetlands, bayhead swamp and marsh meadow.
Seasonality: Species was documented from April through July.

Voucher: Yes **Voucher type:** photo and audio voucher
Capture summary: Species was detected by call surveys, active searching and drift fence arrays.

(9) *Hyla cinerea* (green treefrog)
Taxonomic notes: none
Abundance: abundant
District(s): FL, MS **Park units documented**: Cat Island, Davis Bayou, Petit Bois Island, Perdido Key, Fort Pickens, and Santa Rosa Island.

Habitat associations: Permanent freshwater ponds and wetlands, buildings, high marsh meadow, beach and relic dune ridges, wetpine flatwoods, maritime forest, and bay head swamps.
Seasonality: Species can be found throughout the year.

Voucher: Yes **Voucher type:** photo and audio voucher
Capture summary: Species was detected by call surveys, found under cover objects, found in association with campground buildings and historic ruins, caught on drift fence arrays, and PVC pipes.
General comments: In Davis Bayou, breeding occurs at the Gator pond and the CCC trail pond.

(10) *Hyla femoralis* (pinewoods treefrog)
Taxonomic notes: none
Abundance: uncommon
District(s): FL, MS **Park units documented**: Davis Bayou, Naval Live Oaks

Habitat associations: Pine savanna, wet pine flatwoods and Florida scrub.
Seasonality: Species was heard calling from May to July.

Voucher: Yes **Voucher type:** audio voucher
Capture summary: Species was detected by call surveys.

(11) *Hyla gratiosa* (barking treefrog)
Taxonomic notes: none
Abundance: rare
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Permanent freshwater ponds and bayhead swamp.
Seasonality: In GUIS documented in May to July.

Voucher: none **Voucher type:** NA
Capture summary: Species was detected by call surveys.
General comments: Species was heard from the Gator pond and the CCC Trail pond.

(12) *Hyla squirella* (squirrel treefrog)
Taxonomic notes: none
Abundance: abundant
District(s): FL, MS **Park units documented**: Cat Island, Davis Bayou, Horn Island, Petit Bois Island, Perdido Key, Fort Pickens, Naval Live Oaks, Santa Rosa Island, and Okaloosa Area.

Habitat associations: Permanent freshwater ponds and wetlands, buildings, high marsh meadow, beach and relic dune ridges, wetpine flatwoods, maritime forest, and bay head swamps.
Seasonality: Species can be found throughout the year.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was detected by call surveys, found in association with campground buildings and historic ruins, and PVC pipes.

(13) *Hyla versicolor* (gray treefrog)
Taxonomic notes: none
Abundance: common
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Mixed hardwoods, ephemeral ponds and bayhead swamps.
Seasonality: Species heard calling from February to July.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was documented by call surveys and active searching.
General comments: In Davis Bayou, the majority of gray treefrogs documented were heard calling from the ephemeral pond east of the CCC Trail trailhead.

(14) *Pseudacris crucifer* (spring peeper)
Taxonomic notes: none
Abundance: common
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Ephemeral ponds and bayhead swamps.
Seasonality: Species is heard calling from November to March in Mississippi.

Voucher: none **Voucher type:** NA
Capture summary: Species was identified by call surveys and active search.

(15) *Pseudacris nigrita* (southern chorus frog)
Taxonomic notes: Sub-species in GUIS is *Pseudacris nigrita nigrita.*
Abundance: uncommon
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Pine savanna
Seasonality: Species heard calling in Davis Bayou in February and March.

Voucher: none **Voucher type:** NA
Capture summary: Species identified by call surveys.

(16) *Rana catesbeiana* (bullfrog)
Taxonomic notes: none
Abundance: common
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Freshwater ponds: In Davis Bayou, Entrance ponds, Gator Pond and Visitor's Center Pond.
Seasonality: Species can be found throughout the year.

Voucher: Yes **Voucher type:** photo and audio voucher
Capture summary: Species identified by call survey and active searching.

(17) *Rana clamitans* (bronze frog)
Taxonomic notes: Sub-species found in GUIS is *Rana clamitans clamitans.*
Abundance: common
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Freshwater ponds, ephemeral pond, and bayhead swamp.
Seasonality: Species can be found throughout the year.

Voucher: Yes **Voucher type:** Photo and audio voucher
Capture summary: Species was identified by call surveys, caught in minnow traps, drift fence arrays and by active searching.
General comments: Species' larva was found in most fresh water in Davis Bayou.

(18) *Rana grylio* (pig frog)
Taxonomic notes: none
Abundance: uncommon
District(s): FL, MS **Park units documented**: Davis Bayou and Naval Live Oaks

Habitat associations: Freshwater ponds and wetlands.
Seasonality: Species heard calling from March though June.

Voucher: Yes **Voucher type:** Audio voucher
Capture summary: Species was identified by call surveys.

(19) *Rana sphenocephala* (southern leopard frog)
Taxonomic notes: none
Abundance: common
District(s): FL, MS **Park units documented**: Davis Bayou, Cat Island, West Ship Island, Horn Island, Petit Bois Island, Perdido Key, Santa Rosa Island

Habitat associations: Fresh water wetlands, ponds and slightly brackish water wetlands.
Seasonality: Species heard calling from November to April in Mississippi.

Voucher: Yes **Voucher type:** photo, audio, and preserved specimen
Capture summary: Species was captured by minnow traps active searching drift fence arrays and identified by call surveys.

(20) *Alligator mississippiensis* (American alligator)
Taxonomic notes: none
Abundance: common
District(s): FL, MS **Park units documented**: Cat Island, Davis Bayou, West Ship Island, East Ship Island, Horn Island, Petit Bois Island, and Fort Pickens.

Habitat associations: Freshwater ponds, fresh water wetlands, brackish water wetlands, salt marsh and tidal marsh.
Seasonality: Species is active throughout the year.

Voucher: Yes **Voucher type:** photo
Capture summary: Species identified by active searching.
General comments: Successful reproduction has been witnessed on Cat Island in 2005 and in Davis Bayou in 2007.

(21) *Chelydra serpentina* (snapping turtle)
Taxonomic notes: none
Abundance: uncommon
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Bayhead swamp and tidal marsh
Seasonality: Species is active year round, becoming less active in the winter.

Voucher: Yes **Voucher type:** photo
Capture summary: Species captured in turtle traps and minnow traps.
General comments: In Davis Bayou, two hatchling turtles were caught in a minnow trap suggesting this park unit is a site for successful reproduction.

(22) *Deirochelys reticularia* (chicken turtle)
Taxonomic notes: Sub-species found in GUIS is *Deirochelys reticularia reticularia*, the eastern chicken turtle
Abundance: rare
District(s): FL, MS **Park units documented**: Davis Bayou and Fort Pickens

Habitat associations: Freshwater ponds

Voucher: none **Voucher type: NA**
Capture summary: Species found by active searching.
General comments: An intact carapace was found at Fort Pickens and identified with help by Kurt Buhlman of the University of Georgia.

(23) *Gopherus polyphemus* (gopher tortoise)
Taxonomic notes: none
Abundance: rare
District(s): FL, MS **Park units documented**: Davis Bayou and Naval Live Oaks

Habitat associations: Florida Scrub.
Seasonality: Species is active year round, becoming less active in the winter.

Voucher: none **Voucher type: NA**
Capture summary: Species is annually monitored by GUIS, Florida District Science and Resources management personnel.
General comments: Species requires fire managed habitat to be successful.

(24) *Kinosternon subrubrum* (mud turtle)

Taxonomic notes: Sub-species identified in GUIS was *Kinosternon subrubrum hippocrepis*, the Mississippi mud turtle however the sub-species *Kinosternon subrubrum subrubrum*, the eastern mud turtle may be identified in the future.

Abundance: uncommon

District(s): FL, MS **Park units documented**: Davis Bayou, Perdido Key and Santa Rosa Island

Habitat associations: Freshwater ponds and wetlands, ephemeral ponds and bayhead swamp.

Seasonality:

Voucher: Yes **Voucher type:** Photo and preserved specimen

Capture summary: Species was found via active searching and caught in minnow traps.

General comments: In Davis Bayou, two hatchling turtles were caught in a minnow trap suggesting this park unit is a site for successful reproduction

(25) *Malaclemys terrapin* (diamondback terrapin)

Taxonomic notes: Sub-species in Mississippi and Florida pan-handle is the Mississippi diamondback terrapin (*Malaclemys terrapin pileata*).

Abundance: uncommon

District(s): MS **Park units documented**: Davis Bayou, West Ship Island, and Horn Island.

Habitat associations: Salt marsh.

Seasonality: This species is active year round, becoming less active in the winter.

Voucher: Yes **Voucher type:** photo

Capture summary: Species was found via active searching.

(26) *Terrapene carolina* (box turtle)

Taxonomic notes: Two sub-species were observed in GUIS, Gulf Coast box turtle, (*Terrapene carolina major*) and the three-toed box turtle, (*Terrapene carolina triunguis)*, and their intergrades.

Abundance: abundant

District(s): FL, MS **Park units documented**: Davis Bayou and Perdido Key

Habitat associations: Bayhead swamp, maritime forest, transitional forest, mixed hardwood forest and wetpine flatwood.

Seasonality: Species is active throughout the year.

Voucher: Yes **Voucher type:** photo

Capture summary: Species was caught via active searching.

General comments: Most common turtle species seen in GUIS. Juveniles and hatchlings were found during the survey at Davis Bayou.

(27) *Trachemys scripta* (slider)
Taxonomic notes: In Mississippi the sub-species found was *Trachemys scripta elegans*.
Abundance: common
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Fresh water ponds.
Seasonality: Species is active throughout the year.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was caught via active searching.
General comments: Juveniles were found during the survey at Davis Bayou.

(28) *Anolis carolinensis* (green anole)
Taxonomic notes: none
Abundance: abundant
District(s): FL, MS **Park units documented**: Cat Island, Davis Bayou, West Ship Island, East Ship Island, Horn Island, Petit Bois Island, Perdido Key, Fort Pickens, Santa Rosa Island, Naval Live Oaks, and Okaloosa.

Habitat associations: Buildings, savanna, bayhead swamp, maritime forest, mixed hardwood forest Florida scrub and marsh meadow.
Seasonality: Species is active throughout the year.

Voucher: Yes **Voucher type:** photo
Capture summary: Species found via active searching.
General comments: Species is found on all surveyed park units.

(29) *Eumeces inexpectatus* (Southeastern five-lined skink)
Taxonomic notes: none
Abundance: common
District(s): FL, MS **Park units documented**: Cat Island and Davis Bayou

Habitat associations: Bayhead swamp, mixed forest, and maritime forest.
Seasonality: Found year round when temperatures are warm enough for activity.

Voucher: Yes **Voucher type:** photo and preserved specimen
Capture summary: Species captured in drift fence arrays and via active searching.

(30) *Eumeces laticeps* (broadhead skink)
Taxonomic notes: none
Abundance: uncommon
District(s): FL, MS **Park units documented**: Davis Bayou and Naval Live Oaks

Habitat associations: Maritime forest and mixed hardwood forest.
Seasonality: Species found in June and July.

Voucher: Yes **Voucher type:** photo
Capture summary: Species captured by active searching

(31) *Hemidactylus turcicus* (Mediterranean gecko)
Taxonomic notes: none
Abundance: common
District(s): FL, MS **Park units documented**: Davis Bayou, Perdido Key, Fort Pickens, Santa Rosa Island, Naval Live Oaks, and Okaloosa.

Habitat associations: Buildings and man-made objects
Seasonality: Species was seen active March through July and is vulnerable to mortality when temperatures reach freezing levels.

Voucher: Yes **Voucher type:** photo and preserved specimen
Capture summary: Found via active search methods.
General comments: Exotic species quickly spreading throughout the southeastern United States.

(32) *Ophisaurus ventralis* (eastern glass lizard)
Taxonomic notes: none
Abundance: rare
District(s): FL, MS **Park units documented**: Davis Bayou, Petit Bois Island, Perdido Key, and Fort Pickens.

Habitat associations: Maritime forest and wetpine flatwoods
Seasonality: unknown

Voucher: Yes **Voucher type:** photo
Capture summary: Species was caught in a drift fence array and found via active searching.
General comments: Species in the genus *Ophisaurus* are difficult to distinguish from each other and are of increasing conservation concern in the state of Mississippi.

(33) *Scincella lateralis* (ground skink)
Taxonomic notes: none
Abundance: abundant
District(s): FL, MS **Park units documented**: Cat Island, Davis Bayou, West Ship Island, Perdido Key, and Naval Live Oaks.

Habitat associations: Mixed hardwood forest, maritime forest bayhead swamp and transitional forests.
Seasonality: Species is active throughout the year.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was caught in drift fence arrays, under wood and metal cover boards and found via active searching.

(34) *Sceloporus undulatus* (fence lizard)
Taxonomic notes: none
Abundance: common
District(s): FL **Park units documented**: Naval Live Oaks

Habitat associations: Florida pine scrub
Seasonality: Species is active throughout the year.

Voucher: none **Voucher type:** NA
Capture summary: Found via active search methods.

(35) *Agkistrodon piscivorus* (cottonmouth)
Taxonomic notes: none
Abundance: uncommon
District(s): FL, MS **Park units documented**: Davis Bayou, Horn Island, Petit Bois Island, Perdido Key and Santa Rosa Island

Habitat associations: Aquatic snake found in fresh water marsh, fresh water ponds, brackish water marsh, and marsh meadow.
Seasonality: Species is active throughout the year.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was captured in minnow traps and found via active searching.

(36) *Cemophora coccinea* (scarlet snake)
Taxonomic notes: none
Abundance: rare
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Transition forest.
Seasonality: Species was documented to be active in summer.

Voucher: Yes **Voucher type:** preserved specimen
Capture summary: Species was found via active searching.

(37) *Coluber constrictor* (black racer)
Taxonomic notes: Two sub-species occur with in GUIS, *Coluber constrictor priapus,* southern black racer and *Coluber constrictor latrunculus*, black masked racer.
Abundance: abundant
District(s): FL, MS **Park units documented**: Cat Island, Davis Bayou, West Ship Island, Horn Island, Petit Bois Island, Santa Rosa Island

Habitat associations: Species was found in all terrestrial habitats.
Seasonality: Species is active throughout the year.

Voucher: Yes **Voucher type:** photo and preserved specimen
Capture summary: Species was captured in drift fence arrays and found via active searching.
General comments: Both sub-species were found to occur on Petit Bois Island.

(38) *Diadophis punctatus* (ring necked snake)
Taxonomic notes: Sub-species in GUIS is *Diadophis punctatus stictogenys*, Mississippi ring necked snake.
Abundance: rare
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Mixed hardwood
Seasonality: Species was documented in spring.

Voucher: Yes **Voucher type:** photo
Capture summary: One specimen was found via active search.

(39) *Elaphe guttata* (corn snake)
Taxonomic notes: Sub-species is *Elaphe guttata guttata* in GUIS.
Abundance: rare
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: In Davis Bayou species was found in maritime forest.
Seasonality: Species was documented in summer.

Voucher: Yes **Voucher type:** photo
Capture summary: Captured via active search.

(40) *Elaphe obsoleta* (rat snake)
Taxonomic notes: Two subspecies were documented in GUIS *Elaphe obsoleta lindheimerii*, Texas rat snake and *Elaphe obsoleta spiloides*, gray rat snake.
Abundance: uncommon
District(s): MS **Park units documented**: Cat Island and Davis Bayou

Habitat associations: Mixed hardwood transitional forest and maritime forest.
Seasonality: Species is active from early spring through to summer.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was captured via active searching.

(41) *Lampropeltis getulus* (kingsnake)
Taxonomic notes: Sub-species in GUIS is *Lampropeltis getulus holbrooki*, speckled kingsnake.
Abundance: common
District(s): MS **Park units documented**: Davis Bayou, West Ship Island, and Petit Bois Island

Habitat associations: Mixed Hardwoods and bayhead swamp.
Seasonality: Species is active throughout the year.

Voucher: Yes **Voucher type:** photo
Capture summary: Species caught in drift fence arrays, under wood coverboards and found via active searching.

(42) *Masticophis flagellum* (eastern coachwhip)
Taxonomic notes: *Masticophis flagellum flagellum*, eastern coachwhip
Abundance: rare
District(s): FL, MS **Park units documented**: Petit Bois Island and Santa Rosa Island.

Habitat associations: Maritime forest and March meadow and Florida scrub.
Seasonality: In GUIS species is active in summer.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was caught in drift fence arrays and found via active searching.

(43) *Nerodia clarkii* (salt marsh snake)
Taxonomic notes: *Nerodia clarkii clarkii*
Abundance: common
District(s): MS **Park units documented**: Davis Bayou, West Ship Island, East Ship Island Horn Island and Petit Bois Island.

Habitat associations: Aquatic snake found in salt marsh and salt marsh meadow.
Seasonality: Species is active from March to October in GUIS.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was captured in minnow traps, under cover objects and debris, and found via active searching.

(44) *Nerodia cyclopion* (Mississippi green water snake)
Taxonomic notes: none
Abundance: common
District(s): MS **Park units documented**: West Ship Island, Davis Bayou, and Petit Bois Island.

Habitat associations: Aquatic snake found in fresh water marsh, fresh water ponds, brackish water marsh, and marsh meadow.
Seasonality: Species is active from March to October in GUIS.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was caught in minnow traps drift fence arrays and via active searching.

(45) *Nerodia fasciata* (banded water snake)
Taxonomic notes: *Nerodia fasciata fasciata* banded water snake, *Nerodia fasciata confluens,* broad-banded water snake
Abundance: uncommon
District(s): FL, MS **Park units documented**: Davis Bayou, West Ship Island, Petit Bois Island Fort Pickens, and Santa Rosa Island.

Habitat associations: Aquatic snake found in fresh water marsh, fresh water ponds, brackish water marsh, and marsh meadow.
Seasonality: Species was documented from April through July.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was captured in minnow traps and found via active searching.

(46) *Opheodrys aestivus* (rough green snake)
Taxonomic notes: none
Abundance: rare
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Wetpine flatwoods.
Seasonality: Species is documented to be active in late summer early fall in GUIS.

Voucher: Yes **Voucher type:** photo
Capture summary: Found via active search.
General comments: The rough green snake is a very cryptic species and may be more common than currently suspected.

(47) *Tantilla coronata* (Southeastern crowned snake)
Taxonomic notes: none
Abundance: rare
District(s): MS **Park units documented**: Davis Bayou

Habitat associations: Bayhead swamp and mixed hardwood forest.
Seasonality: Species documented in late spring and early summer in GUIS.

Voucher: Yes **Voucher type:** photo
Capture summary: Species was found via active searching, and under cover objects.

(48) *Thamnophis sauritus* (eastern ribbon snake)
Taxonomic notes: Sub-species in GUIS is, *Thamnophis sauritus sauritus*, eastern ribbon snake.
Abundance: common
District(s): MS **Park units documented**: Cat Island, Davis Bayou, Petit Bois Island and Fort Pickens.

Habitat associations: Semi aquatic snake found near freshwater ponds and marshes and in bayhead swamps.
Seasonality: Species found in spring and summer.

Voucher: Yes **Voucher type:** photo
Capture summary:

(49) *Thamnophis sirtalis* (eastern garter snake)
Taxonomic notes: Sub-species in GUIS is, *Thamnophis sirtalis sirtalis*, eastern garter snake.
Abundance: rare
District(s): MS **Park units documented**:. Cat Island, West Ship Island and Fort Pickens

Habitat associations: Maritime forest, marsh meadow and buildings.
Seasonality: Species found in spring.

Voucher: none **Voucher type:** NA
Capture summary: Species was captured in drift fence arrays and via active searching.

SUMMARY OF GENETIC STUDY OF *Nerodia Clarkii Clarkii*

Modification 2 to cooperative agreement Cooperative Agreement H2115030006 was originally designed to look at how island herpetofaunal populations and communities are biogeographically related to each other on a molecular and morphological basis. Specifically, we planned to collect genetic materials from three common island species: *Hyla squirella, Rana sphenocephala,* and *Cnemidophorus sexlineatus* and compare individual variation.

Unfortunately, due to the effects of Hurricane Katrina, we were unable to collect a sufficient amount of tissue samples to accomplish any kind of useful genetic analysis. We were however presented with a unique opportunity to examine aspects of the taxonomic status of *Nerodia*

clarkii clarkii. Results of the genetic analysis are available in a separate final report submitted to the NPS.

EFFECTS OF HURRICANE IVAN ON HERPTOFAUNAL COMMUNITIES

Hurricanes are important large scale disturbance events can alter the physical and biological environments of coastal ecosystems within the Gulf of Mexico. In particular, coastal barrier islands are easily affected by large storm events due to their predisposition for dynamic change. Although the physical and geological effects on the environment are often studied, the biological impacts on faunal communities have only recently received attention.

Hurricane Ivan struck the Gulf Coast on September 16, 2004 making landfall at Gulf Shores, Alabama less than 25 miles west of GUIS Florida units. A storm surge of 10-15 ft occurred along the coast from Destin in the Florida panhandle westward to Mobile Bay/Baldwin County, Alabama (Stewart 2005). Maximum sustained winds of 105 knots (approximately 130 mph) were recorded and a maximum wind gust of 135 UNIT was recorded at a weather buoy south of Mobile, AL (Stewart 2005). Figure 14, an overflight photograph of a section of Santa Rosa Island after Ivan made landfall, shows the physical damage to the island habitats. In the photo's foreground, Highway 399 can be seen broken into pieces along the island's south beach. To the north, salt water inundation is visible in the over-washed pools and forested areas appear severely wind damaged.

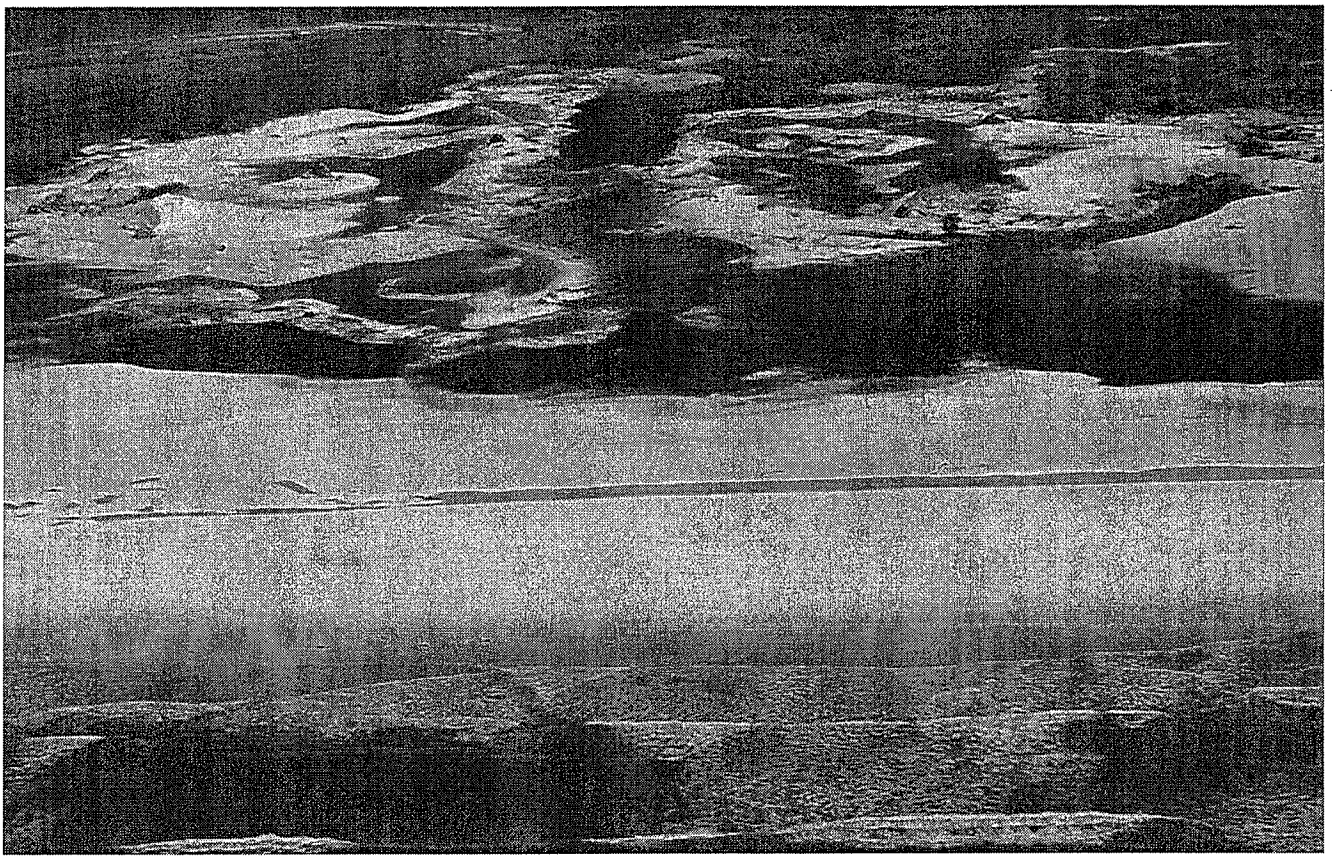

Figure 14: Santa Rosa Island, September 18, 2004. (Photo courtesy of GUIS SR&M).

With a sampling season completed prior to the storm, an opportunity was available to observe the effects of a hurricane's impact on barrier island herpetofaunal communities. Starting in the winter of 2005, comparable surveys were conducted to identify effects on the island herpetofaunal communities.

The results of the 2005 post-Ivan survey showed a combined 66.6% decrease in species richness for both Perdido Key (13 to 3 species) and Santa Rosa Island (14 to 6 species), shown in Tables 10 and 11. The 76.9 % decrease in species richness seen in the Perdido Key unit is likely due to its proximity to where the storm made landfall. For the species that persisted after the hurricane, aspects of their biology may explain their continued presence. Squirrel treefrogs (*Hyla squirella*) are very abundant and small enough that some individuals could have easily

found refugia to survive the storm. Southern leopard frogs (*Rana sphenocephala*) are mobile aquatic/terrestrial frogs with tolerance to brackish water (Cristman 1974). Six-lined racerunners (*Cnemidophorus sexlineatus*) are extremely mobile lizards that would have likely been able to escape to areas above the storm surge on the modestly sized sand dunes and ridges on the island.

As shown in Table 11, species on Santa Rosa Island fared slightly better than those on Perdido Key. A decrease of 57.1% was seen in the herpetofaunal richness on the island. It is likely that mobile species such as *Cnemidophorus sexlineatus* and *Masticophis f. flagellum* were able to seek refuge in the large dune habitats on the island, and that *Agkistrodon piscivorus* fared well due to its aquatic nature. It is unclear why no *Coluber constrictor priapus* and *Nerodia fasciata fasciata* were detected since they would have had they same mobility as *Masticophis f. flagellum* and *Agkistrodon piscivorus*. Other species that were detected on the island after Ivan were similarly terrestrial species and included *Bufo terrestris, Gastrophryne carolinensis,* and *Rana sphenocephala.* Arboreal species such as *Hyla cinerea, Hyla squirella,* and *Anolis carolinensis* were not detected on Santa Rosa Island after the storm. These species are abundant wherever they occur, so their absence may not be a coincidence. Since these species would likely seek refuge in trees, extreme wind damage may have played a role in their local extirpation.

Table 10: Hurricane Ivan herpetofaunal community change at Perdido Key, FL.

Species	2004 pre-Ivan	2005 post-Ivan
Bufo quercicus	present	
Gastrophryne carolinensis	present	
Hyla cinerea	present	
Hyla squirella	present	present
Rana sphenocephala	present	present
Kinosternon subrubrum	present	
Terrapene carolina major	present	

Anolis carolinensis	present	
Cnemidophorus sexlineatus	present	present
Hemidactylus turcicus	present	
Ophisaurus ventralis	present	
Scincella lateralis	present	
Agkistrodon piscivorus	present	

Table 11: Hurricane Ivan herpetofaunal community change at Santa Rosa Island, FL.

Species	2004 pre-Ivan	2005 post-Ivan
Bufo terrestris	present	present
Gastrophryne carolinensis	present	present
Rana sphenocephala	present	present
Hyla cinerea	present	
Hyla squirella	present	
Kinosternon subrubrum	present	
Anolis carolinensis	present	
Cnemidophorus sexlineatus	present	present
Hemidactylus turcicus	present	
Agkistrodon piscivorus	present	present
Coluber constrictor priapus	present	
Masticophis flagellum flagellum	present	present
Nerodia fasciata fasciata	present	

EFFECTS OF HURRICANE KATRINA ON HERPETOFAUNAL COMMUNITIES

Modification 3 to Cooperative Agreement H2115030006 was a follow-up study to the initial 2004-2005 herpetofaunal survey of GUIS. Conducted in 2006, this survey examined the initial effects of Hurricane Katrina on GUIS amphibian and reptile communities.

Prior to Hurricane Katrina, herpetofaunal profiles were completed for the Mississippi park units. With the passage of that storm, a unique opportunity existed to examine first-hand the effects of a large-scale hurricane on these well studied faunal populations. Additionally, in the biogeographic context of the Mississippi Gulf Islands, storm effects are of great importance when considering how animals move in coastal island systems, i.e., local extinction, colonization and re-colonization.

We conducted surveys on Davis Bayou, West Ship Island, East Ship Island and Petit Bois Island to determine changes in species richness. Davis Bayou prior to Hurricane Katrina had the highest species richness of any GUIS park unit with 45 taxa. Following the storm, shown by Table 12, species richness dropped 26 % to a species richness of 33. The majority of species that were not identified after the storm were already identified to either be uncommon or rare in occurrence. These species are likely not locally extinct from Davis Bayou, but rather more likely down in numbers and haven't yet recovered to pre-storm abundances. Species that were classified as either abundant or common were easily found after the storm, with the notable decrease of *Amphiuma means*. This is likely due to the salt water inundation of its fresh water habitat. In areas affected by storm surge the species is no longer found where once it was readily captured.

West Ship Island also had a decrease in species richness like the other surveyed park units, see Table 13. Unlike the other park units, West Ship Island had a change in the community composition of it water snakes. Prior to Hurricane Katrina the dominant snake caught on West Ship Island was *Nerodia cyclopion*, a fresh-water, water snake. Following the storm the dominant water snake was *Nerodia clarkii clarkii*, as mentioned before a species adapted to salt water environments. This change is important because it shows, first hand, ecological succession on these barrier islands.

On East Ship Island only two species were found after the Hurricane Katrina, see Table 14. *Nerodia clarkii clarkii* and *Malaclemys terrapin pileata* were both found by NPS S&RM personnel outside of our survey. The presence of these species can be explained to their adaptations for life in salt water environments.

Shown in Table 15, post Katrina surveys of Petit Bois Island also found only two species. The salt tolerant *Nerodia clarkii clarkii* was found and the terrestrial *Cnemidophorus sexlineatus*. The presence of C. *sexlineatus* indicates that Petit Bois Island was not completely submerged during the storm and areas of refugia existed.

Table 12: Hurricane Katrina herpetofaunal community change at Davis Bayou, MS.

Species	2004-2005 pre-Katrina	2006 post-Katrina
Amphiuma means	present	present
Eurycea quadridigitata	present	
Plethodon mississippi	present	present
Acris gryllus gryllus	present	present
Bufo quercicus	present	
Bufo terrestris	present	present
Gastrophryne carolinensis	present	present
Hyla cinerea	present	present
Hyla versicolor	present	present
Hyla femoralis	present	
Hyla gratiosa	present	
Hyla squirella	present	present
Pseudacris crucifer	present	present
Pseudacris nigrita nigrita	present	
Rana catesbeiana	present	present
Rana clamitans clamitans	present	present
Rana grylio	present	present
Rana sphenocephala	present	present
Alligator mississippiensis	present	present
Chelydra serpentina	present	present
Deirochelys reticularia	present	
Gopherus polyphemus	present	
Kinosternon subrubrum	present	present
Malaclemys terrapin pileata	present	present
Terrapene carolina	present	present
Trachemys scripta elegans	present	present
Anolis carolinensis	present	present
Eumeces inexpectatus	present	present
Eumeces laticeps	present	
Hemidactylus turcicus	present	present
Ophisaurus ventralis		present
Scincella lateralis	present	present
Agkistrodon piscivorus	present	present
Cemophora coccinea	present	
Coluber constrictor priapus	present	present

Elaphe guttata guttata	present	
Elaphe obsoleta	present	present
Diadophis punctatus punctatus	present	
Lampropeltis getulus holbrooki	present	present
Nerodia clarkii clarkii	present	present
Nerodia cyclopion	present	present
Nerodia fasciata fasciata	present	present
Opheodrys aestivus	present	
Tantilla coronata	present	present
Thamnophis sauritus sauritus	present	present

Table 13: Hurricane Katrina herpetofaunal community change at West Ship Island

Species	2004-2005 pre-Katrina	2006 post-Katrina
Rana sphenocephala	present	
Alligator mississippiensis	present	
Malaclemys terrapin pileata		present
Cnemidophorus sexlineatus	present	present
Anolis carolinensis		present
Scincella lateralis	present	
Coluber constrictor latrunculus	present	
Lampropeltis getulus holbrooki	present	
Nerodia clarkii clarkii	present	present
Nerodia cyclopion	present	present
Nerodia fasciata confluens	present	
Thamnophis sirtalis sirtalis	present	

Table 14: Hurricane Katrina herpetofaunal community change at East Ship Island, MS.

Species	2004-2005 pre-Katrina	2006 post-Katrina
Alligator mississippiensis	present	
Malaclemys terrapin pileata		present
Anolis carolinensis	present	
Cnemidophorus sexlineatus	present	
Agkistrodon piscivorus	present	
Nerodia clarkii clarkii	present	present

Table 15: Hurricane Katrina herpetofaunal community change at Petit Bois Island, MS.

Species	2004-2005 pre-Katrina	2006 post-Katrina
Hyla cinerea	present	
Hyla squirella	present	
Rana sphenocephala	present	
Alligator mississippiensis	present	
Anolis carolinensis	present	

Cnemidophorus sexlineatus	present	present
Ophisaurus ventralis	present	
Agkistrodon piscivorus	present	
Coluber constrictor latrunculus	present	
Coluber constrictor priapus	present	
Lampropeltis getulus holbrooki	present	
Masticophis flagellum flagellum	present	
Nerodia clarkii clarkii		present
Nerodia cyclopion	present	
Nerodia fasciata fasciata	present	
Thamnophis s. sauritus	present	

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Appendix A: Museum holdings of GUIS herpetofaunal specimens

- Records were searched from, Auburn University Natural History Museum and Learning Center, Chicago Field Museum, Florida Museum of Natural History, Harvard Museum of Comparative Zoology, Louisiana State University Museum of Natural Science, Mississippi Museum of Natural Science, Tulane Museum of Natural History, University of Alabama and the University of Michigan Museum of Zoology.
- Taxonomy is presented as documented in museum records.
- Place names have not been updated, ex. Magnolia State Park is present day Davis Bayou.

Species	Locality	Year	Collection/ Locality ID
Auburn University Natural History Museum and Learning Center			
Masticophis flagellum	Santa Rosa Island	1982	AUM 31672
Chicago Field Museum			
Bufo terrestris	Ship Island	1936	93711 6502
Bufo terrestris	Horn Island	1959	194071 1638
Cnemidophorus sexlineatus	Ship Island	1936	94786 5891-5898
Cnemidophorus sexlineatus	Ship Island	1936	94787 5891-5898
Cnemidophorus sexlineatus	Ship Island	1936	94788 5891-5898
Cnemidophorus sexlineatus	Ship Island	1936	94789 5891-5898
Cnemidophorus sexlineatus	Ship Island	1936	94790 5891-5898
Cnemidophorus sexlineatus	Ship Island	1936	94791 5891-5898
Cnemidophorus sexlineatus	Ship Island	1936	94792 5891-5898
Cnemidophorus sexlineatus	Ship Island	1936	94793 5891-5898
Cnemidophorus sexlineatus	Horn Island	1959	194343 1636
Cnemidophorus sexlineatus	Horn Island	1959	194339 1634
Cnemidophorus sexlineatus	Horn Island	1959	194340 1632
Cnemidophorus sexlineatus	Horn Island	1959	194342 1635
Cnemidophorus sexlineatus	Horn Island	1930	21494 155
Coluber constrictor	Horn Island	1960	194495 2053
Eurycea cirrigera	Magnolia State Park	1957	193705 803
Kinosternon subrubrum	Magnolia State Park	1957	194292 799
Kinosternon subrubrum	Magnolia State Park	1957	194273 800
Kinosternon subrubrum	Magnolia State Park	1957	194290 801
Lampropeltis getulus	Horn Island	1959	192871 1639
Nerodia clarkii	Horn Island	1930	21562 392
Plethodon mississippi	Magnolia State Park	1957	192347 802
Pseudotriton montanus	Magnolia State Park	1957	193905 804
Scincella lateralis	Cat Island	1930	21455 285
Terrapene carolina	Magnolia State Park	1957	193112 805
Terrapene carolina	Magnolia State Park	1957	194240 806
University of Alabama Herpetology Collection			
Agkistrodon piscivorus	Ft. Pickens	no data	UAHC 50-462
Bufo quercicus	Ship Island	1958	UAHC 65-3072
Bufo quercicus	Ship Island	1958	UAHC 65-3073
Bufo quercicus	Ship Island	1958	UAHC 65-3074
Bufo quercicus	Ship Island	1958	UAHC 65-3075
Kinosternon subrubrum	Ship Island	1958	UAHC 65-3076

Appendix A: Museum record of specimens collected from GUIS localities.

Species	Locality	Year	Collection/ Locality ID	
Florida Museum of Natural History				
Lepidochelys kempii	Horn Island vicinity	1982	56374	
Rana pipiens	Santa Rosa Island	1934	1959-7	
Harvard Museum of Comparative Zoology				
Hyla squirella	Horn Island	1982	MCZ A-106105	ZA106105
Hyla squirella	Horn Island	1982	MCZ A-106106	ZA106105
Kinosternon subrubrum hippocrepis	Horn Island	1976	MCZ R-175742	ZR175742
Masticophis flagellum flagellum	Cat Island	1859	MCZ R-778	ZR778
Masticophis flagellum flagellum	Cat Island	1859	MCZ R-779	ZR778
Nerodia fasciata faciata	Cat Island	1859	MCZ R-792	ZR778
Anolis carolinensis carolinensis	Horn Island	1982	MCZ R-164478	ZR164476
Anolis carolinensis carolinensis	Horn Island	1982	MCZ R-164479	ZR164476
Anolis carolinensis carolinensis	Horn Island	1982	MCZ R-164480	ZR164476
Anolis carolinensis carolinensis	Horn Island	1982	MCZ R-164481	ZR164476
Anolis carolinensis carolinensis	Horn Island	1982	MCZ R-164482	ZR164476
Anolis carolinensis carolinensis	Horn Island	1982	MCZ R-164483	ZR164476
Cnemidophorus sexlineatus	Horn Island	1982	MCZ R-164477	ZR164477
Scincella lateralis	Horn Island	1982	MCZ R-164476	ZR164476
Lampropeltis getula holbrooki	Cat Island	1859	MCZ R-808	ZR808
Agkistgrodon piscivorous conanti	Fort Pickens	1984	MCZ R-169210	ZR169205
Chelydra serpentina serpentina	Fort Pickens	1984	MCZ R-169206	ZR169205
Crotalus adamanteus	Fort Pickens	1984	MCZ R-169209	ZR169205
Kinosternon minor minor	Fort Pickens	1984	MCZ R-169205	ZR169205
Nerodia cyclopion floridana	Fort Pickens	1984	MCZ R-169208	ZR169205
Opheodrys aestivus	Fort Pickens	1984	MCZ R-169207	ZR169205
Louisiana State University Museum of Natural Science				
Agkistrodon piscivorus	Horn Island	no data	41499	
Cnemidophorus sexlineatus	Horn Island	no data	41498	
Cnemidophorus sexlineatus	Ship Island	no data	50285	
Cnemidophorus sexlineatus	Ship Island	no data	50286	
Cnemidophorus sexlineatus	Ship Island	no data	50287	
Cnemidophorus sexlineatus	Ship Island	no data	50288	
Cnemidophorus sexlineatus	Ship Island	no data	50289	
Ophisaurus ventralis	Santa Rosa Island	no data	57966	
Mississippi Museum of Natural Science Herpetology Collection				
Bufo terrestris	Horn Island	1937	6985	
Bufo terrestris	Cat Island	1940	6989	
Bufo terrestris	Cat Island	1940	7000	
Bufo terrestris	Horn Island	1958	7341	
Bufo terrestris	Cat Island	1940	7529	
Bufo terrestris	Cat Island	1940	7594	
Thamnophis sauritus	Ship Island	1953	2505	
Thamnophis sauritus	Magnolia State Park	1953	2524	
Thamnophis sauritus	Magnolia State Park	1953	2525	
Elaphe guttata guttata	Davis Bayou	1963	3126	
Nerodia clarkii	Horn Island	1972	8018	
Coluber constrictor	Magnolia State Park	1957	8090	
Coluber constrictor	Magnolia State Park	1957	8091	
Micrurus fulvius fulvius	Magnolia State Park	1954	2247	

Appendix A: Museum record of specimens collected from GUIS localities.

Species	Locality	Year	Collection/ Locality ID	
Mississippi Museum of Natural Science Herpetology Collection, continued				
Eurycea guttolineata	Magnolia State Park	1952	6452	
Plethodon mississippi	Magnolia State Park	1963	12303	
Plethodon mississippi	Magnolia State Park	1963	12304	
Plethodon mississippi	Magnolia State Park	1963	12305	
Plethodon mississippi	Magnolia State Park	1963	12306	
Plethodon mississippi	Magnolia State Park	1963	12307	
Plethodon mississippi	Magnolia State Park	1963	12339	
Plethodon mississippi	Magnolia State Park	1963	12339	
Agkistrodon piscivorus	Magnolia State Park	1956	1458	
Agkistrodon piscivorus	Ship Island	1949	1463	
Tulane Museum of Natural History				
Rana utricularia	Cat Island	1934	TU 473	NA
University of Michigan Museum of Zoology				
Bufo terrestris	Cat Island	1930	76970	500-3
Bufo terrestris	Horn Island	1931	76974	600-1
Hyla squirella	Cat Island	1930	76935	354
Hyla squirella	Horn Island	1930	76933	351-3
Nerodia cyclopion	Horn Island	1944	93970	NA
Scincella lateralis	Cat Island	1930	76862	286-9
Thamnophis proximus	Cat Island	1930	76787	394

Appendix B: National Park Service Bibliography of Herpetofaunal Research in Gulf Islands National Seashore (Source: Naturebib, NPSpecies).

Boyd, J. L., R. W. Heard and J. A. Mclelland. 1995. An Inventory of Pond Fauna of the Gulf Islands National Seashore with Parasitological and Trophic Observations. Gulf Coast Research Laboratory, Ocean Springs, MS. G.C.R.L. Rep. 04:8-04-95.

Jacks, A. R. 1997. An Assessment of the Sea Turtle Monitoring Program at Gulf Islands National Seashore.Thesis.University of West Florida Thesis.

Jackson, J. A. 1983. Studies of the Biology of Endangered and Threatened Species of Gulf Islands National Seashore, Mississippi. Proceedings of the Northern Gulf of Mexico Estuaries and Barrier Islands Research Conference. Biloxi, MS, United States Depart

Lewis, T. E., D. Atencio, R. Butgereit, S. M. Shea and K. Watson. 1995. Sea Turtle Nesting and Management in Northwest Florida.

Mays, J. L. and D. J. Shaver. 1998. Nesting Trends of Sea Turtles in National Seashores along Atlantic and Gulf Coast Waters of the United States. Columbia Environmental Research Center, Padre Island National Seashore, Corpus Christi, TX. Final Report

Nicholas, M. and A. R. Jacks. 1996. Sea Turtle Nesting Report - Gulf Islands National Seashore, Florida District (1994-1996). Gulf Islands National Seashore, Gulf Breeze, FL.

Richmond, E. A. 1962. The Flora and Fauna of Horn Island, Mississippi. Gulf Research Reports. 1:59-106.

Seigel, R. A. and J. S. Doody. 1996. Final Report Summary: Inventory and Monitoring of Amphibians and Reptiles of the Gulf Islands National Seashore. Department of Biological Sciences, Southeastern Louisiana University, Hammond, LA.

Seigel, R. A. and J. S. Doody. 1996. Inventory and Monitoring of Amphibians and Reptiles of the Gulf Islands National Seashore. The authors are associated with Southeastern Louisiana University, Hammond, Louisiana.

Zimmerman, C. S. and G. W. Hopkins. 1992. An Assessment of Nesting Sea Turtles within Gulf Islands National Seashore - 1989-1991.

Appendix C: Checklist of the amphibians of GUIS.

Amphibian Species	Common name	District	
Salamanders			
Amphiuma means	two-toed amphiuma	Mississippi	Florida
Eurycea cirrigera	southern two lined salamander	Mississippi	Florida
Eurycea guttolineata	three lined salamander	Mississippi	
Eurycea quadridigitata	dwarf salamander	Mississippi	
Notophthalmus viridescens	red newt		Florida
Plethodon mississippi	slimy salamander	Mississippi	Florida
Pseudotriton montanus	mud salamander	Mississippi	
Frogs			
Acris gryllus gryllus	southern cricket frog	Mississippi	Florida
Bufo quercicus	oak toad	Mississippi	Florida
Bufo terrestris	southern toad	Mississippi	Florida
Eleutherodactylus planirostris	greenhouse frog		Florida
Gastrophryne carolinensis	eastern narrowmouth toad	Mississippi	Florida
Hyla andersonii	Pine Barrens tree frog		Florida
Hyla cinerea	green treefrog	Mississippi	Florida
Hyla versicolor	gray treefrog	Mississippi	Florida
Hyla femoralis	pinewoods treefrog	Mississippi	Florida
Hyla gratiosa	barking treefrog	Mississippi	Florida
Hyla squirella	squirrel treefrog	Mississippi	
Pseudacris crucifer	spring peeper	Mississippi	
Pseudacris nigrita nigrita	southern chorus frog	Mississippi	
Pseudacris ornata	ornate chorus frog	Mississippi	Florida
Rana catesbeiana	bullfrog	Mississippi	
Rana clamitans clamitans	bronze frog	Mississippi	Florida
Rana grylio	pig frog	Mississippi	Florida
Rana sphenocephala	southern leopard frog	Mississippi	Florida

Appendix D: Checklist of the Reptiles of GUIS.

Reptile Species	Common name	District	
Crocodilians			
Alligator mississippiensis	American alligator	Mississippi	Florida
Turtles			
Chelydra serpentina	snapping turtle	Mississippi	Florida
Deirochelys reticularia	chicken turtle	Mississippi	Florida
Gopherus polyphemus	gopher tortoise	Mississippi	Florida
Kinosternon subrubrum	mud turtle	Mississippi	Florida
Malaclemys terrapin pileata	diamondback terrapin	Mississippi	
Pseudemys concinna	river cooter	Mississippi	
Pseudemys floridana	Florida river cooter		Florida
Terrapene carolina major	Gulf Coast box turtle	Mississippi	Florida
Terrapene carolina triunguis	three-toed box turtle	Mississippi	
Trachemys scripta scripta	yellow-bellied slider		Florida
Trachemys scripta elegans	red-eared slider	Mississippi	
Lizards			
Anolis carolinensis	green anole	Mississippi	Florida
Cnemidophorus sexlineatus	six-lined racerunner	Mississippi	Florida
Eumeces egregius	mole skink		Florida
Eumeces inexpectatus	southeastern five-lined skink	Mississippi	
Eumeces laticeps	broad-headed skink	Mississippi	Florida
Hemidactylus turcicus	Mediterranean gecko	Mississippi	Florida
Ophisaurus ventralis	eastern glass lizard	Mississippi	Florida
Sceloporus undulatus	fence lizard		Florida
Scincella lateralis	ground skink	Mississippi	Florida
Snakes			
Agkistrodon piscivorus	eastern cottonmouth	Mississippi	Florida
Agkistrodon contortrix	copperhead	Mississippi	
Cemophora coccinea	scarlet snake	Mississippi	Florida
Coluber constrictor latrunculus	black-masked racer	Mississippi	
Coluber constrictor priapus	southern black racer	Mississippi	Florida
Crotalus adamanteus	diamondback rattlesnake		Florida
Diadophis punctatus stictogenys	Mississippi ringneck snake	Mississippi	
Elaphe guttata guttata	corn snake	Mississippi	Florida
Elaphe obsoleta lindheimerii	Texas rat snake	Mississippi	
Elaphe obsoleta spiloides	gray rat snake	Mississippi	
Farancia erytrogramma	rainbow snake	Mississippi	
Heterodon platirhinos	eastern hognose snake	Mississippi	Florida
Lampropeltis getulus holbrooki	speckled kingsnake	Mississippi	
Masticophis flagellum flagellum	eastern coachwhip	Mississippi	Florida
Micrurus fulvius fulvius	eastern coral snake	Mississippi	Florida
Nerodia clarkii	salt marsh snake	Mississippi	

Nerodia cyclopion	Mississippi green water snake	Mississippi	
Nerodia erythrogaster	yellow-bellied water snake		Florida
Nerodia fasciata confluens	broad-banded water snake	Mississippi	
Nerodia fasciata fasciata	banded water snake	Mississippi	
Nerodia floridana	Florida green water snake		Florida
Nerodia taxispilota	brown water snake		Florida
Opheodrys aestivus	rough green snake	Mississippi	Florida
Sistrurus miliarius	pygmy rattlesnake	Mississippi	Florida
Storeria dekayi	brown snake	Mississippi	
Storeria occipitomaculata	red-bellied snake		Florida
Tantilla coronata	southeastern crowned snake	Mississippi	Florida
Thamnophis sauritus sauritus	eastern ribbon snake	Mississippi	Florida
Thamnophis sauritus sauritus	eastern garter snake	Mississippi	Florida
Thamnophis proximus	western ribbon snake	Mississippi	

Appendix E: The status of herpetofaunal in Gulf Island Nation Seashore.

Status categories are listed below as defined in Attachment A of the scope of work provided by the Gulf Coast Network's Biological Inventory:

> Present: Species' occurrence in park is documented and assumed to be extant.
> Historic: Species' historical occurrence in the park is documented, but recent investigations indicate that the species is now probably absent.
> Probably Present: Park is within the species' range and contains appropriate habitat. Documented occurrences of the species in the adjoining region of the park give reason to suspect that it probably occurs within the park. The degree of probability may vary within this category, including species that range from common to rare.
> Unconfirmed: Included for the park based on weak "unconfirmed record" or no evidence, giving minimal indication of the species' occurrence in the park.
> False Report: Species previously reported to occur within the park, but current evidence indicates that the report was based on a misidentification, a taxonomic concept no longer accepted, or some other similar problem of interpretation.

Amphibian Species	Common name	Status
Salamanders		
Amphiuma means	two-toed amphiuma	present
Eurycea cirrigera	southern two-lined salamander	historic
Eurycea guttolineata	three-lined salamander	historic
Eurycea quadridigitata	dwarf salamander	present
Notophthalmus viridescens	red newt	probably present
Plethodon mississippi	slimy salamander	present
Pseudotriton montanus	mud salamander	historic
Frogs		
Acris gryllus gryllus	southern cricket frog	present
Bufo quercicus	southern toad	present
Eleutherodactylus planirostris	greenhouse frog	present
Gastrophryne carolinensis	eastern narrowmouth toad	present
Hyla cinerea	green treefrog	present
Hyla versicolor	gray treefrog	present
Hyla femoralis	pinewoods treefrog	present
Hyla gratiosa	barking treefrog	present
Hyla squirella	squirrel treefrog	present
Pseudacris crucifer	spring peeper	present
Pseudacris nigrita nigrita	southern chorus frog	present
Pseudacris ornata	ornate chorus frog	probably present
Rana catesbeiana	bullfrog	present
Rana clamitans clamitans	bronze frog	present
Rana grylio	pig frog	present
Rana sphenocephala	southern leopard frog	present

Reptile Species	Common name	Status
Crocodilians		
Alligator mississippiensis	American alligator	present
Turtles		
Chelydra serpentina	snapping turtle	present
Deirochelys reticularia	chicken turtle	present
Gopherus polyphemus	gopher tortoise	present
Kinosternon subrubrum	mud turtle	present
Malaclemys terrapin pileata	MS diamondback terrapin	present
Pseudemys floridana	Florida river cooter	probably present
Pseudemys concinna	river cooter	historic
Terrapene carolina major	Gulf Coast box turtle	present
Terrapene carolina triunguis	three-toed box turtle	present
Sternotherus minor minor	loggerhead musk turtle	historic
Trachemys scripta elegans	red-eared slider	present
Trachemys scripta scripta	yellow-bellied slider	probably present
Lizards		
Anolis carolinensis	green anole	present
Cnemidophorus sexlineatus	six-lined racerunner	present
Eumeces egregius	mole skink	probably present
Eumeces inexpectatus	SE five-lined skink	present
Eumeces laticeps	broad-headed skink	present
Hemidactylus turcicus	Mediterranean gecko	present
Ophisaurus ventralis	eastern glass lizard	present
Sceloporus undulatus	fence lizard	present
Scincella lateralis	ground skink	present
Snakes		
Agkistrodon piscivorus	eastern cottonmouth	present
Agkistrodon c. contortrix	copperhead	historic
Cemophora coccinea	scarlet snake	present
Coluber constrictor latrunculus	black-masked racer	present
Coluber constrictor priapus	southern black racer	present
Crotalus adamanteus	diamondback rattlesnake	probably present
Diadophis punctatus stictogenys	MS ringneck snake	present
Elaphe g. guttata	corn snake	present
Elaphe obsoleta lindheimerii	Texas rat snake	present
Elaphe obsoleta spiloides	gray rat snake	present
Farancia erytrogramma	rainbow snake	historic
Heterodon platirhinos	eastern hognose snake	probably present
Lampropeltis getulus holbrooki	speckled kingsnake	present
Masticophis flagellum flagellum	eastern coachwhip	present
Micrurus fulvius fulvius	eastern coral snake	probably present
Nerodia clarkii	salt marsh snake	present
Nerodia cyclopion	MS green water snake	present

Nerodia erythrogaster	yellow-bellied water snake	probably present
Nerodia fasciata confluens	broad-banded water snake	present
Nerodia fasciata fasciata	banded water snake	present
Nerodia floridana	Florida green water snake	probably present
Nerodia taxispilota	brown water snake	probably present
Opheodrys aestivus	rough green snake	present
Sistrurus miliarius	pygmy rattlesnake	probably present
Storeria dekayi	brown snake	historic
Storeria occipitomaculata	red-bellied snake	probably present
Tantilla coronata	SE crowned snake	present
Thamnophis sauritus sauritus	eastern ribbon snake	present
Thamnophis sirtalis sirtalis	eastern garter snake	present
Thamnophis proximus	western ribbon snake	historic

Appendix F: Saffir-Simpson Hurricane Scale (Source: National Hurricane Center)

Category One Hurricane:

Winds 74-95 mph (64-82 kt or 119-153 km/hr). Storm surge generally 4-5 ft above normal. No real damage to building structures.

Category Two Hurricane:

Winds 96-110 mph (83-95 kt or 154-177 km/hr). Storm surge generally 6-8 feet above normal. Some roofing material, door, and window damage of buildings.

Category Three Hurricane:

Winds 111-130 mph (96-113 kt or 178-209 km/hr). Storm surge generally 9-12 ft above normal. Some structural damage to small residences and utility buildings with a minor amount of curtainwall failures.

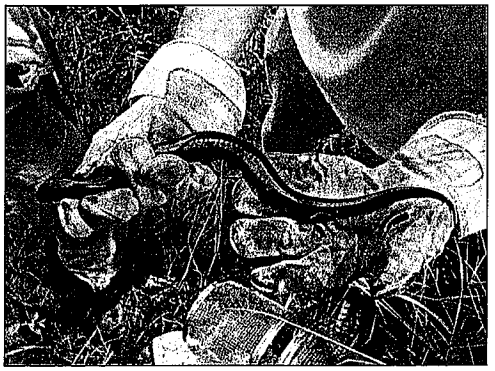
Category Four Hurricane:

Winds 131-155 mph (114-135 kt or 210-249 km/hr). Storm surge generally 13-18 ft above normal. More extensive curtainwall failures with some complete roof structure failures on small residences.

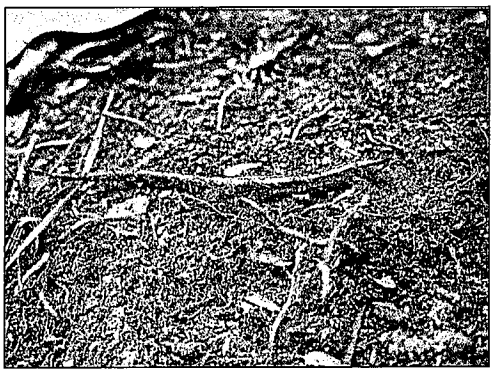
Category Five Hurricane:

Winds greater than 155 mph (135 kt or 249 km/hr). Storm surge generally greater than 18 ft above normal. Complete roof failure on many residences and industrial buildings.

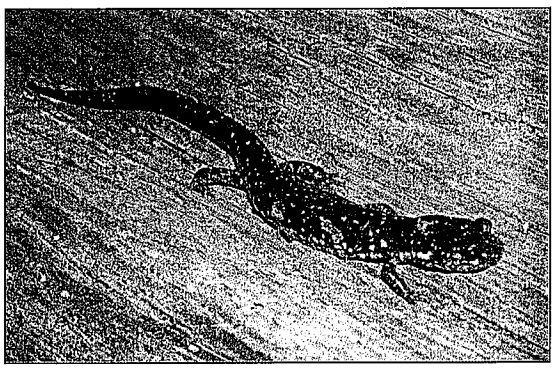
Appendix G: Photographs of herpetofaunal specimens caught in GUIS.



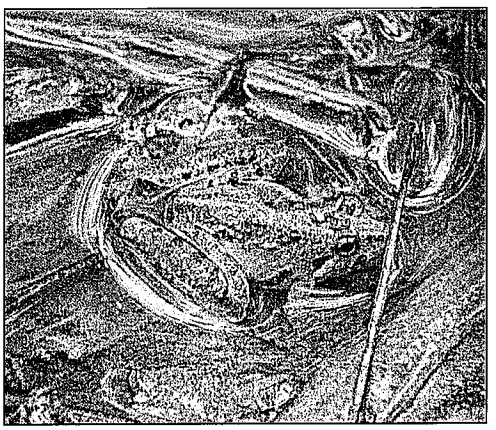
Two-toed Amphiuma
(*Amphiuma means*)



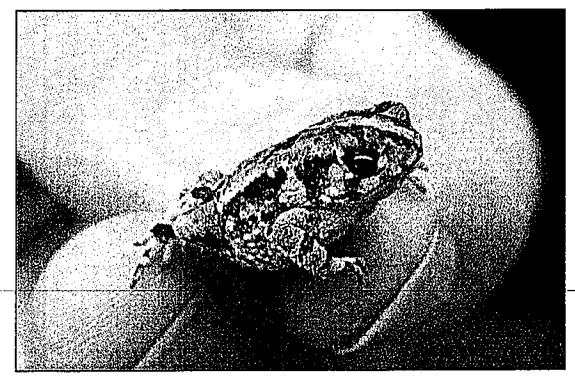
Dwarf Salamander
(*Eurycea quadridigitata*)



Slimy Salamander
(*Plethodon mississippi*)

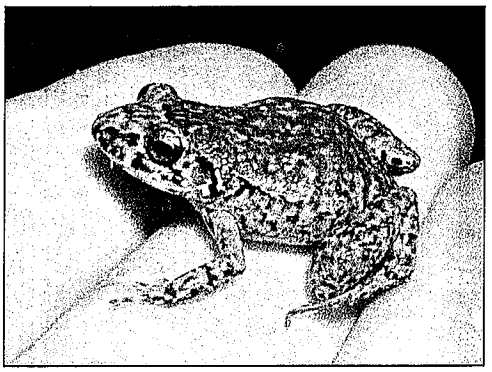


Southern Cricket Frog
(*Acris gryllus gryllus*)

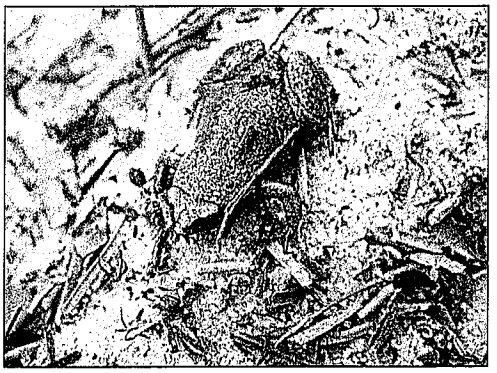


Oak Toad
(*Bufo quercicus*)

Southern Toad
(*Bufo terrestris*)



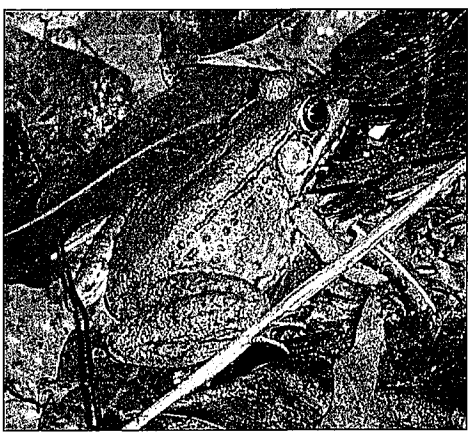
Greenhouse Frog ***Non-native***
(*Eleutherodactylus planirostris*)



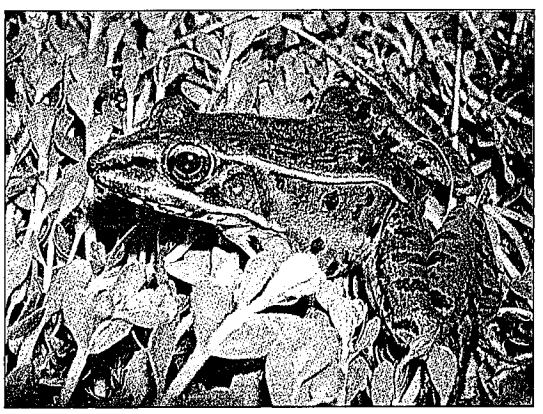
Narrowmouth Toad
(*Gastrophryne carolinensis*)

Green Treefrog
(*Hyla cinerea*)

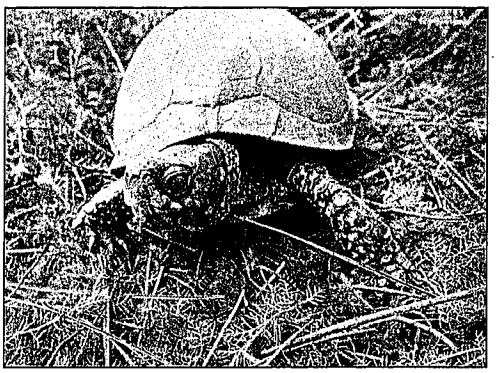
Squirrel Treefrog
(*Hyla squirella*)



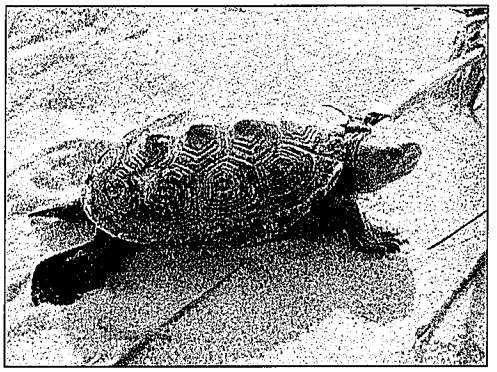
Bronze Frog
(*Rana clamitans clamitans*)



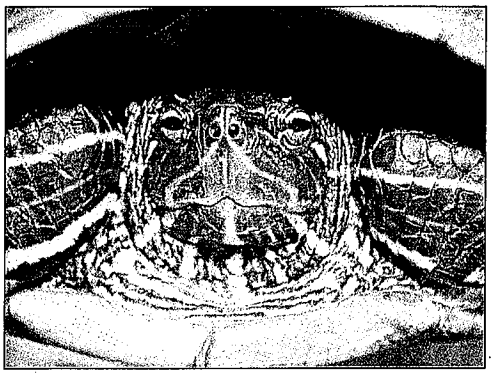
Southern Leopard Frog
(*Rana sphenocephala*)



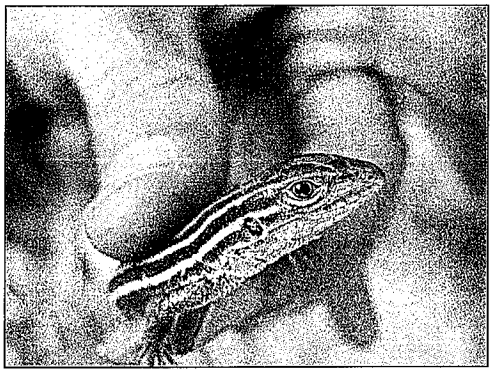
Gulf Coast Box Turtle
(*Terrapene carolina major*)



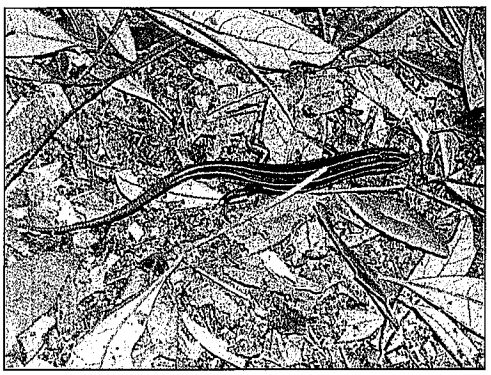
Mississippi Diamondback Terrapin
(*Malaclemys terrapin pileata*)



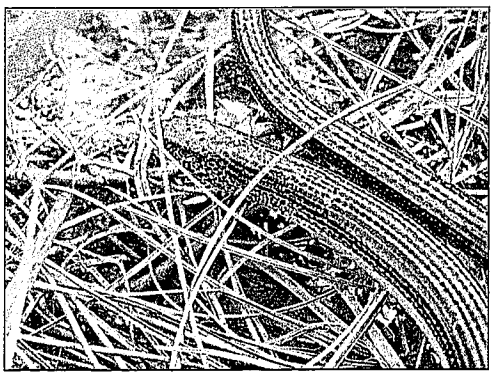
Red-eared Slider
(*Trachemys scripta elegans*)



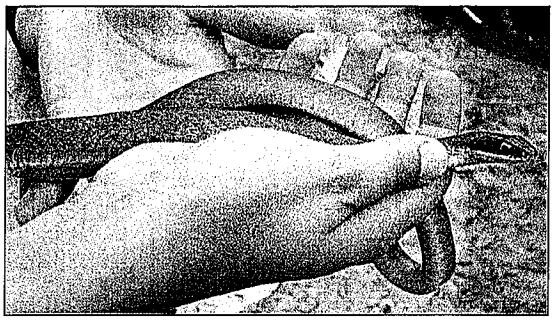
Six-lined Racerunner
(*Cnemidophorus sexlineatus*)



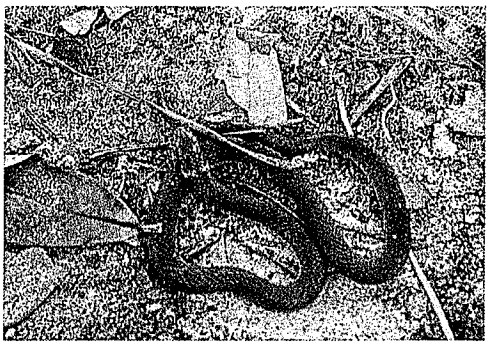
Southeastern Five-lined Skink
(*Eumeces inexpectatus*)



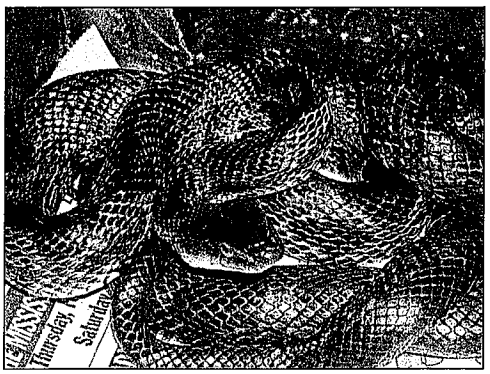
Eastern Glass Lizard
(*Ophisaurus ventralis*)



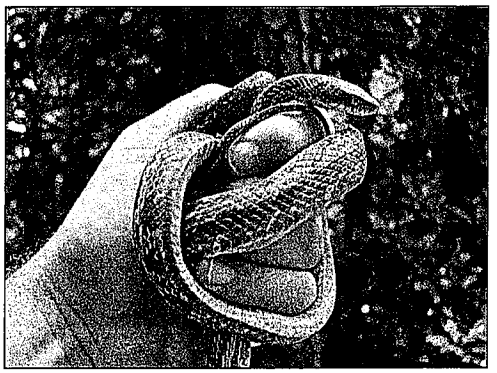
Black-masked Racer
(*Coluber constrictor latrunculus*)



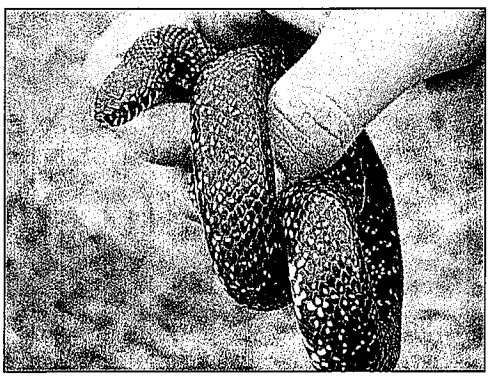
Mississippi Ringneck Snake
(*Diadophis punctatus stictogenys*)



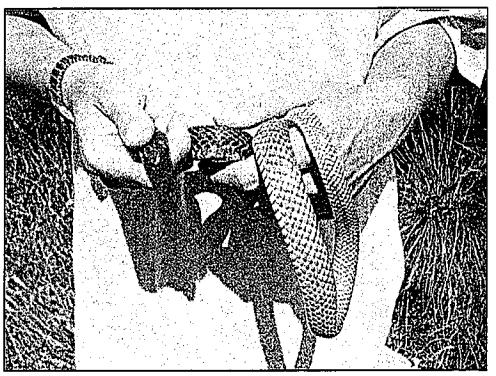
Texas Rat Snake
(*Elaphe obsoleta lindheimerii*)



Gray Rat Snake
(*Elaphe obsoleta spiloides*)

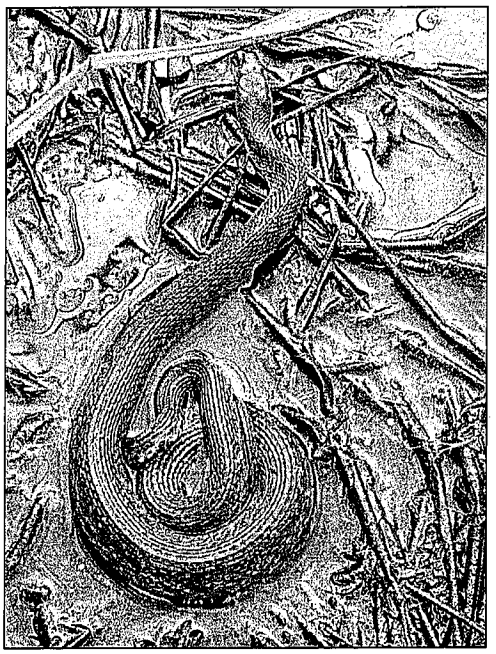


Eastern Kingsnake
(*Lampropeltis getulus holbrooki*)

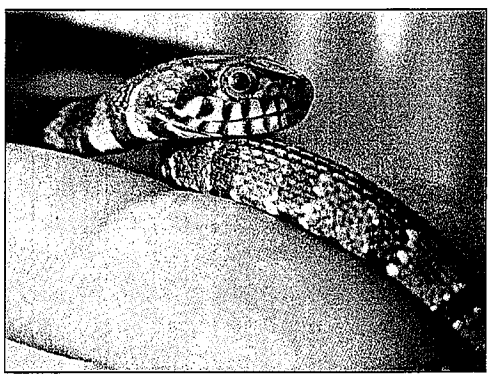


Eastern Coachwhip
(*Masticophis flagellum flagellum*)

Gulf Salt Marsh Snake
(*Nerodia clarkii*)

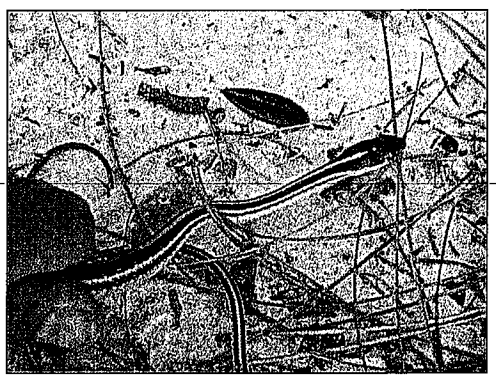


Mississippi Green Water Snake
(*Nerodia cyclopion*)



Banded Water Snake
(*Nerodia fasciata fasciata*)

Rough Green Snake
(*Opheodrys aestivus*)



Eastern Ribbon Snake
(*Thamnophis sauritus sauritus*)

Photographs by: Thomas Mohrman,
Sam Holcomb, and Krista Noel